"CORRELATION BETWEEN PERIPHERAL PERFUSION INDEX MEASURED BY PULSE OXIMETER AND BLOOD PRESSURE IN NEONATES MORE THAN 35 WEEKS OF GESTATIONAL AGE"

Dissertation submitted to

THE TAMILNADU DR.M.G.R.MEDICAL UNIVERSITY

In partial fulfillment of the regulations
for the award of the degree of

DM (NEONATOLOGY)

THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY

CHENNAI

APRIL 2014

CERTIFICATE

This is to certify that the dissertation entitled **"CORRELATION BETWEEN PERIPHERAL PERFUSION INDEX MEASURED BY PULSE OXIMETER AND BLOOD PRESSURE IN NEONATES MORE THAN 35 WEEKS OF GESTATION"** is a bonafide work done by **Dr.K.SENTHILKUMAR** under my guidance and supervision during the period between November 2013 – March 2014 towards the partial fulfillment of requirement for the award of **D.M.(Neonatology)** degree examination to be held in August 2014 by The Tamilnadu Dr.M.G.R. Medical University, Chennai.

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DECLARATION

I solemnly declare that this study title **"CORRELATION BETWEEN PERIPHERAL PERFUSION INDEX MEASURE BY PULSE OXIMETER AND BLOOD PRESSURE IN NEONATES MORE THAN 35WKS OF GESTATION"** was my original work in the Department of Neonatology, Institute of Child Health and Hospital for Children, Egmore, Chennai under the guidance and supervision of **Prof.Dr.J.Kumutha, MD.,DCH.,** Professor & Head of the department , Department of Neonatology, Madras Medical College , Chennai. This dissertation is submitted to The Tamilnadu Dr.M.G.R. Medical University, Chennai in partial fulfillment of the university requirements for the award of the degree of D.M. Neonatology

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Dear Dr. Senthil Kumar.k ,

The Institutional Ethics Committe of Madras Medical College reviewed and discussed your application for approval of the proposal ***"Correlation between Peripheral Perfusion index measure by Pulse oximeter and Blood pressure in Newborn ≥ 35wks of Gestation"*** No.29112013

The following members of Ethics Committee were present in the meeting held on 13.11.2013 conducted at Madras Medical College , Chennai – 3 .

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We approve the proposal to be conducted in its presented form.

Sd / Chairman & Other Members

The Institutional Ethics Committee experts to be informed about the progress of the study , and SAE occurring in the course of the study , any change in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

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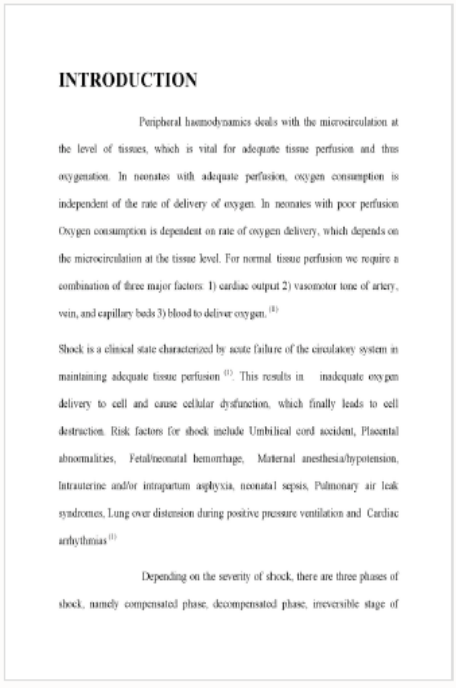
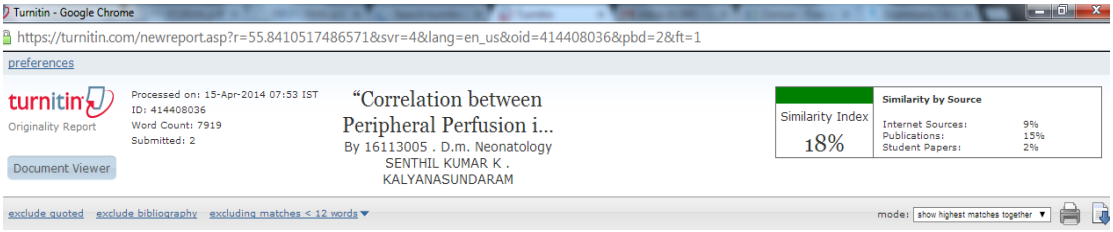


INTRODUCTION

Peripheral haemodynamics deals with the microcirculation at the level of tissues, which is vital for adequate tissue perfusion and thus oxygenation. In neonates with adequate perfusion, oxygen consumption is independent of the rate of delivery of oxygen. In neonates with poor perfusion Oxygen consumption is dependent on rate of oxygen delivery, which depends on the microcirculation at the tissue level. For normal tissue perfusion we require a combination of three major factors: 1) cardiac output 2) vasomotor tone of artery, vein, and capillary beds 3) blood to deliver oxygen. [1]

Shock is a clinical state characterized by acute failure of the circulatory system in maintaining adequate tissue perfusion [1]. This results in inadequate oxygen delivery to cell and cause cellular dysfunction, which finally leads to cell destruction. Risk factors for shock include Umbilical cord accident, Placental abnormalities, Fetal/neonatal hemorrhage, Maternal anesthesia/hypotension, Intrauterine and/or intrapartum asphyxia, neonatal sepsis, Pulmonary air leak syndromes, Lung over distension during positive pressure ventilation and Cardiac arrhythmias [1]

Depending on the severity of shock, there are three phases of shock, namely compensated phase, decompensated phase, irreversible stage of



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INTRODUCTION

Peripheral haemodynamics determines oxygen and nutrient delivery to the tissues of the newborn infant. This deals with the microcirculation at the level of tissues, which is vital for adequate tissue perfusion and thus oxygenation. In neonates with adequate perfusion, oxygen consumption is independent of the rate of delivery of oxygen. In neonates with poor perfusion oxygen consumption is dependent on the rate of oxygen delivery, which depends on the microcirculation at the tissue level. For normal tissue perfusion a combination of three major factors is required; good cardiac output, integrity of vasomotor tone and ability of blood to deliver oxygen. [(1)]

Shock is a clinical state characterized by acute failure of the circulatory system in maintaining adequate tissue perfusion [(1)]. This results in inadequate oxygen delivery to cells and causes cellular dysfunction, which finally leads to cell destruction. Risk factors for shock include umbilical cord accident, placental abnormalities, fetal / neonatal hemorrhage, maternal anesthesia / hypotension, intrauterine and/or intrapartum asphyxia, neonatal sepsis, pulmonary air leak syndromes, lung over distension during positive pressure ventilation and cardiac arrhythmias. [(1)]

Depending on the severity of shock, there are three phases of shock, namely compensated phase, decompensated phase, and irreversible stage of shock. In the "compensated phase of shock," autonomic compensatory mechanisms maintain normal blood flow to the vital organs like heart, brain, and adrenal glands. Blood flow to the nonvital organs like skin, kidney decreases. There is vasodilatation of the blood vessels to vital organs and vasoconstriction of the blood vessels to the nonvital organs. As blood flow to nonvital organs is compromised, there are clinical signs of poor peripheral perfusion like cold extremities, poor pulse volume, prolonged capillary refill time and decreased urine output. In compensated shock, blood pressure is maintained within the normal limit, and heart rate increases. [18]

If adequate treatment is not initiated, babies will develop hypotension due to failure of the sympathetic mechanisms and shock enters into "uncompensated phase." Cardiac output (systemic blood flow) will decrease, blood flow to all organs is compromised and oxygen delivery to the vital organs is also compromised resulting in lactic acidosis. If uncompensated shock is not treated quickly and effectively, multiorgan dysfunction develops and shock enters into "irreversible phase," where permanent damage to the various organs will occur and

further treatment will be ineffective in reverting the shock and the baby's condition . [18]

Earlier identification and management of poor perfusion / shock in newborns can reduce the mortality and morbidities like acute tubular necrosis, disseminated intravascular coagulopathy (DIC), gastrointestinal bleeding, hypoxic-ischemic injury to the brain and necrotizing enterocolitis. [34] Direct assessment of tissue perfusion is difficult and is usually assessed indirectly by clinical features. These include cold extremities, poor pulse volume, prolonged capillary refill time, heart rate changes and blood pressure. [7] The clinical parameters are liable to subjective variation, so there is a need for an objective parameter for diagnosing the shock.

Perfusion index is an assessment of the pulsatile strength, and it is an indirect measure of peripheral perfusion. Pulse oximeter is widely used for monitoring arterial saturation. The signal comprises two components, one which is arterial and pulsatile and the other, which is non-pulsatile and originates from connective tissue, bone, and venous blood. In deriving the signal for arterial saturation monitoring, only the pulsatile component is analyzed. However, by computing the ratio between the pulsatile component and the non-pulsatile component of the light reaching the detector of the pulse oximeter, a peripheral perfusion

index (PI) can be calculated. Peripheral perfusion alteration is accompanied by a variation in the pulsatile component and no change in the non-pulsatile component. There is a change in the ratio, which is displayed by the pulse oximeter. The Infrared light signals are used because it is less affected by changes in arterial saturation than the red light signals. [32].

$$\text{Perfusion index} = \frac{\text{Pulsatile signals of infrared}}{\text{Non pulsatile signals of infrared}} \times 100$$

It is expressed as a percentage. The Perfusion index value ranges from 0.02% (very weak pulse) to 20% (very strong pulse) [33].

Shock is a common occurrence in sick neonate, if not treated properly shock leads to high mortality and morbidity. Early identification of shock is mandated to improve the outcome. Currently, clinical parameter is used in the assessment of shock which is liable to subjective variation. As perfusion index is an indirect measure of peripheral perfusion, which is an objective parameter displayed in pulse oximeter. So we planned a study to know the relationship between perfusion index and blood pressure and make use of perfusion index as an objective parameter to predict shock.

REVIEW OF LITERATURE

Shock is a clinical challenge to Neonatologists and pediatricians even today. It occurs in critically ill babies for many reasons. Shock is a complex clinical syndrome characterized by acute failure of the circulatory system to maintain adequate tissue and organ perfusion. This leads to inadequate oxygen and nutrient substrate delivery to body tissues. The hemodynamic status of newborns is usually estimated by the interpretation of indirect parameters of systemic blood flow, like blood pressure, heart rate, capillary refill time and urine output.

WHO Guidelines for assessing shock in newborn include [17]

Weak & faster pulse (Heart rate more than180/min) and capillary refill time more than 3 Sec and extremities cold to touch, with or without the following signs; Lethargy, not arousable on stimulation and pale color

Heart rate changes

An increase in heart rate is the most effective way to increase cardiac output in neonate, because the ability to increase stroke volume is limited. (Cardiac output is a product of heart rate and stoke volume). Low systemic blood flow is considered when tachycardia is present. An increase in heart rate for compensation of low cardiac output can only be effective when end diastolic volume is maintained. In addition, when the

heart rate is too high, diastolic coronary blood flow can be impeded due to insufficient filling time, which might result in a decrease in contractility. Thus neonatal tachycardia is a reliable sign of hypotension and circulatory inadequacy. [4]

Gupta S in his study found rapid heart rates more than 180 beats per minute (bpm) and slow heart rates of less than 80 bpm are likely to compromise cardiac output if they persist for a prolonged length of time.[1]

Problem with heart rate in assessing poor circulation

Problems with the use of heart rate in assessment of shock in the Neonate are many. The normal heart rate of a neonate has a wide range.[37] There are many factors other than shock/hypotension like hunger, pain, agitation, raised body temperature, excessive noise levels, and pharmacological agents which can cause tachycardia in neonates [38]. Many neonates with hypotension can have hypoxia or myocardial damage, which in turn can decrease heart rate. Hence tachycardia alone is not an indicator of shock. [4]

Despite these issues, assessment of heart rate may be useful and should be considered in the neonate with suspected hypotension. A clear

increase from a previous stable baseline value in the absence of other factors causing tachycardia, should suggest circulatory compromise. [4]

Capillary refill time (CRT)

Capillary refill time (CRT) is defined as "the time required for the return of color after the application of a blanching pressure to a distal capillary bed" [39]. The upper normal has been accepted as being three seconds in a neonate. [7]

In a study done by Strozik on 469 healthy term and preterm neonates at 1 to 7 days of age demonstrated significant site and observer variations when CRT was measured on the chest, forehead, palm, and heel. [28]

Raichur et al reported that when two independent observers measured capillary refill time at the forehead, chest, palm, and heel in 155 healthy term neonates, there was good intraobserver repeatability when capillary refill time was measured on the chest but not on the forehead, palm or heel.[29]

Raju et al found, that Capillary refill time of less than or equal to three seconds is traditionally accepted as normal. A capillary refill time of 4.23 ± 1.47 seconds was reported in a large population of healthy neonates during the first 72 postnatal hours. Capillary refill time does not

appear to change during the first 72 postnatal hours in healthy term neonates. Environmental, axillary, hand, and foot temperatures have been indirectly related to capillary refill time. [29]

Capillary refill time and systemic blood flow

Martin Kluckow studied Superior vena cava flow in 39 neonates (both term and preterm) for 48 hours of birth and concluded that Superior vena cava flow is a noninvasive measurement to assess systemic blood flow in newborn infants. [35]

Osborn et al conducted a study to detect low Superior vena cava (SVC) blood flow using capillary refill time, central–peripheral temperature difference, and blood pressure in 128 preterm neonates. The study showed that on the first day of life central–peripheral temperature difference did not correlate with low Superior vena cava flow and that blood pressure and capillary refill time were imperfect predictors of low SVC flow. [27]

Capillary refill time more than three seconds had a sensitivity of 55% and a specificity of 81% in predicting low Superior vena cava blood flow. There is a lack of evidence to use CRT as a single indicator of a hypovolemic state in the neonatal population. [27]

Wodey and colleagues studied 100 neonates about the relationship between capillary refill time and Echo parameters like shortening fraction, cardiac index, left atrial diameter to aortic diameter ratio, blood pressure and heart rate. In his observation, he found no correlation between capillary refill time and left atrial diameter/aortic diameter ratio, shortening fraction, blood pressure or heart rate. However, a significant correlation between capillary refill time and cardiac index was observed. [40]

Capillary refill time and blood pressure

LeFlore and Engle studied healthy term neonates at 1-4 hours after delivery. Brief (1-2 Sec) and extended (3-4 Sec) pressure was applied at various anatomic sites, and a significant direct correlation was observed between blood pressure and capillary refill time, suggesting that vasoactive substances present in the early post-delivery period caused increased vascular resistance, increased blood pressure and prolonged capillary refill time. [4]

In Very low birth weight (VLBW) neonates, a poor correlation was observed between the capillary refill times assessed on the forehead, sternum, and toe, and mean blood pressure, urine output, and SVC flow (Miletin et al). [30]

Central–peripheral temperature difference (CPTd)

In normal neonate central to peripheral temperature difference will be less than1 ^{0}C during the first postnatal days. Central to peripheral temperature difference depends on body temperature, environmental temperature and the use of vasoactive drugs. CPTd of more than 2^{0} C is significant. In a study done by Tibby et al and Osborn et al they found no relation between central to peripheral temperature difference and systemic blood flow, stroke volume index or systemic vascular resistance. The predictive value of CPTd is insufficient to be used in the assessment of neonatal shock [(41)].

Blood pressure and shock

Measurement of blood pressure has been the most frequently used methods for assessment of the hemodynamic status in a neonatal intensive care unit. Three different definitions of neonatal hypotension are in widespread use. The first definition is a blood pressure below the tenth percentile of normative blood pressure values derived from a reference population with regard to gestational age, birth weight and postnatal age. The second and most used definition of neonatal hypotension is that the lower border of normal mean arterial blood pressure (MABP) equals the numeric value of gestational age (GA) in whole weeks. The third definition of neonatal hypotension, i.e. MABP

less than30 mm Hg, is based on the assumption that cerebral blood flow becomes pressure dependent at a MABP around 30 mm Hg.

Relationship between blood pressure and phases of shock [30]

In a Compensated phase of shock, blood pressure of the neonate is maintained within the normal range due to sympathetic activity, in the uncompensated phase of shock neonate develop hypotension due to failure of the autonomic mechanisms [30].

Relationship between blood pressure and type of shock [34]

In all types of shock (except early septic shock) total peripheral resistance (diastolic blood pressure) is increased and the pulse pressure is decreased. (Table – 1)

Table: 1 Blood pressure and type of shock

CVS Features	Hypovolemic	Cardiogenic	Early septic (warm)	Late septic (cold)
Arterial BP	Low	Low	Low	Low
Central venous pressure	Low	Low	Normal	High
Pulse pressure	Decreased	Decreased	Normal	Decreased
Total peripheral resistance	High	High	Low	High
Cardiac output	Low	Low	Normal/ High	Low
Core & peripheral skin temperature difference	Increased	Increased	Normal / Decreased	Increased

Blood pressure measurement

Martin et al conducted a randomized controlled trial in Sixty four neonates between 26 to 37 weeks to compare the blood pressure measurement taken, by standard protocol with the blood pressure measurement taken by a nurse, in different body positions (supine & prone) of the baby. He found that the mean blood pressure was significantly lower in prone position than in supine positions (45.7 vs 47.8 mm Hg, $P < 0.002$). In both positions, the first measurement was significantly higher than the third measurement (difference was 3 mm Hg, $P < 0.003$). These differences, although statistically significant, are not of clinical relevance. Mean blood pressure obtained by a nurse were significantly higher than standard protocol in either position (54.4 vs 47.0 or 49.1 mm Hg, $P < 0.003$). So the blood pressure measured by using the standard protocol will be representative of the basal blood pressure of that baby. In the study, blood pressure is measured in the right upper limb in supine position when the baby is quite.

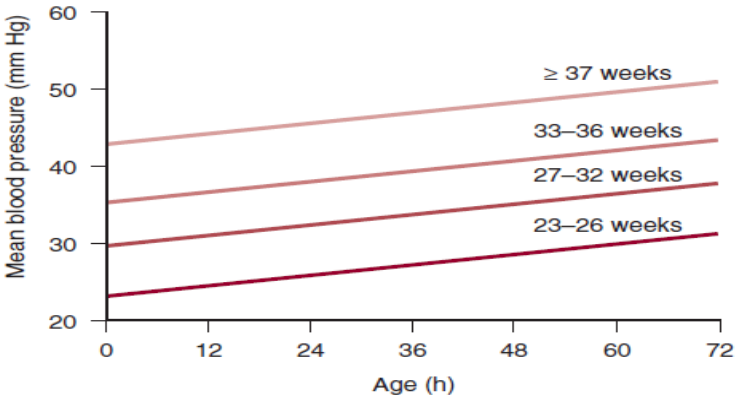


Figure :1 Mean blood pressure normogram

Nuntnarumit P, et al derived a normogram (figure- 1) for the mean arterial pressure from 103 neonates with gestational ages between 23 and 43 weeks from continuous arterial blood pressure measurements. 90% of infants for each gestational age group are expected to have a mean blood pressure equal to or greater than the value indicated by the corresponding line [(2)].

Zubrow et al measured Systolic BP (SBP) and diastolic BP (DBP) by oscillometry method. They recorded blood pressure every 8 hours and found, that during the first five days of life there was a progressive rise in Systolic blood pressure (2.23 to 2.67 mm Hg/day) and Diastolic blood pressure (1.58 to 2.02 mm Hg/day) regardless of gestational age or weight at birth. After day 5 there was a more gradual increase in the daily Systolic blood pressure (0.24 to 0.27 mm Hg/day) and Diastolic blood pressure (0 to 0.15 mm Hg/day) [(25)].

Noninvasive Blood pressure vs invasive Blood pressure

Fanaroff and Wright reported that mean blood pressure during the first 48 postnatal hours, determined by the oscillometric technique, exceeded direct readings by about 3 mm Hg. However, the cuff size was not reported. Others have also reported a tendency for oscillometric determinations to exceed direct measurements. Wareham and colleagues noted that diastolic blood pressure was overestimated by the oscillometric method, and both systolic and mean blood pressures were underestimated. It is of concern that several investigators have found that blood pressure determined by oscillometry overestimates directly obtained blood pressure.

In a prospective study conducted in a tertiary University Centre by Meyer S, et al, simultaneous measurements of both invasive blood pressure (IBP) and noninvasive blood pressure (NIBP) in 50 preterm neonates 6h, 12h, 18h and 24 h after birth was taken. There was a significant correlation and agreement between IBP and NIBP measurements irrespective of birth weight and gestational age [(22)].

Non invasive blood pressure and cuff size

Sonesson and Broberger [(4)] reported that mean blood pressure was overestimated when using a cuff width to arm circumference ratio of

0.33-0.42. Accuracy improved with a ratio of 0.44-0.55. In the study by Kimble [4] and colleagues, the appropriate cuff width to arm circumference ratio was 0.45-0.70.

Table: 2 Predictive values of different hemodynamic variables

variable	Cut off Value	Sensitivity(%)	specificity(%)	Positive predictive value(%)	Negative predictive value(%)	Reference
MAP	Less than gestation age	30	88	71	85	Osborn et al[27]
Capillary refill time	>3 s	55	80	33	91	
	>4 s	29	96	55	88	
CPTd	$\geq 2^0$ c	40	69	23	83	
Combination of clinical variable	MAP < 30 + CRT ≥ 3sec	78	63	31	NA	

So the combination of clinical variable such as capillary refill time, blood pressure, cool peripheries, heart rate increase the predictive value of clinical parameter to predict shock. (Table -2)

Perfusion index

Perfusion index reflects the peripheral vasomotor tone. Low Perfusion index indicates peripheral vasoconstriction (or severe hypovolemia) and high perfusion index indicates vasodilatation. Perfusion index is sensitive to sympathetic nervous system tone (pain, anxiety), the temperature of the finger, exogenous vasoactive drugs and stroke volume [10].

The fingertip is the standard monitoring site for pulse oximeter. The hand or foot is often used in neonatal patients for monitoring perfusion index [32].

Study from Lima AP, et al [9] and Francesco Cresi et al [23] found perfusion index has skewed distribution with a median of 1.4 (0.7-3) and 1.3 (0.9) respectively.

Francesco Cresi et al in his study on stable preterm found perfusion index shows increasing trends in early postnatal days. There is a significant increase between the first and third day. Perfusion index values (median) on First day, Third day and Seventh day are 0.9 (0.6), 1.2 (1.0), 1.3 (0.9) respectively [23].

Perfusion index vs blood flow

Patrizia Zaramella in a 43 healthy term neonates studied the relationship between foot perfusion index, obtained by pulse oximeter, and oxygen delivery, oxygen consumption, fractional oxygen extraction, and blood flow, measured indirectly by near-infrared spectroscopy (NIRS) on the calf of the neonate. There is a positive correlation between the foot perfusion index and oxygen delivery (r=0. 32, p=0. 03) And between perfusion index and calf blood flow (r=0. 32, p=0. 03). There is no correlation between the foot perfusion index and calf fractional oxygen extraction and between foot perfusion index and oxygen

consumption. The foot perfusion index was 1.26±0.39. [11]

S Takahashi, et al studied the correlation between perfusion index and superior vena cava flow (SVC) after birth in neonates born before 32 weeks of gestation. A positive correlation was found between the Perfusion index and SVC flow (r=0. 509, P=0. 001). Perfusion index of 0.44 detected low SVC flow with a 87.5% Sensitivity, 86.3% Specificity, 38.9% Positive predictive value, 98.6% Negative predictive value. The perfusion index can be used as a noninvasive, continuous monitoring of peripheral perfusion. [19]

Perfusion index vs Neonatal illness

De Felice et al (2002) in his study found perfusion index of less than 0.86 ± 0.26, predicts high illness severity (by Score for Neonatal Acute Physiology (SNAP)) in neonates with 95.5% sensitivity, 93.7 % specificity, 91.2% positive predictive value, 96.8% negative predictive value. [21]

Table: 3 Perfusion index and illness severity

Parameters	Low severity	High severity
Perfusion index	2.02 ± 0.70	0.86 ± 0.26
Spo2	95.1% ± 3.9%	93.3% ± 5.4%
Pulse rate	133± 17 bpm	139 ± 16 bpm

De Felice et al (2005) done a study, and showed perfusion index, as an early predictor of subclinical chorioamnionitis in term newborns

and found perfusion index values of 1.74 at one minute, and 2.18 at five minutes, after delivery has a sensitivity of 100%, specificity of 99. 4%, Positive predictive value of 93.7%, Negative predictive value of 100%, in identifying subclinical chorioamnionitis [20].

Perfusion index vs poor peripheral circulation

Lima AP in his study found a significant correlation between the perfusion index and the core-to-toe temperature difference (R2=. 52; p <. 001). A cutoff value of perfusion index was 1. 4 (calculated by constructing a ROC curve) which reflected poor peripheral perfusion in critically ill patients – This study was done in the adult population [9].

Perfusion index vs blood pressure

In a Study by Yamada, Perfusion Index decreased significantly (4.2±1.8 vs. 2.5±1.2, P<0.001), heart rate and mean arterial pressure increased significantly after tracheal intubation which indicates perfusion index is used to detect vasoconstrictive response of tracheal intubation in adults [8].

Hosam M Atef in an adult, studied whether changes in perfusion index correlate with non-invasive haemodynamic criteria (HR, SBP, DBP) following LMA and ET insertion. He found perfusion Index is a reliable alternative to conventional haemodynamic criteria for detection of stress response following ET tube insertion [10].

STUDY JUSTIFICATION

Many of the parameters used in the clinical assessment of newborn shock are subjective and results in either under diagnosis or over diagnosis. These parameters are liable to greater inter observer variability. So there is a need for objective identification /assessment of poor perfusion in the newborn which will be useful in early identification and management of the sick babies.

Given the very many problems in identification of shock we wanted to study if perfusion index could be a useful objective parameter in assessment of shock. Also the intent was to study the relationship between perfusion index and blood pressure (systolic, diastolic, mean arterial blood pressure and pulse pressure.)

Since there are no studies in neonates which looked at the direct relationship between blood pressure and peripheral perfusion index measured by pulse oximeter we undertook this study.

RESEARCH QUESTION

Can perfusion index measured by pulse oximeter detect poor peripheral circulation (shock) in neonates more than 35 weeks of gestational age?

HYPOTHESIS

Perfusion index measured by pulse oximeter can predict early shock.

OBJECTIVE

To find the correlation between perfusion index and blood pressure (systolic blood pressure, diastolic blood pressure, mean arterial pressure and pulse pressure) and to study if perfusion index can predict clinical shock in neonates more than 35 weeks of gestation.

OUTCOME

PRIMARY OUTCOME

- Correlation between the Peripheral perfusion index and Blood pressures (systolic blood pressure, diastolic blood pressure, mean arterial pressure and pulse pressure) - correlation coefficient
- Sensitivity, Specificity, positive predictive value, negative predictive value, positive likely hood ratio, negative likely hood ratio between peripheral perfusion index and clinically assessed shock by constructing a receiver operating characteristic curve (ROC curve)

SECONDARY OUTCOME

- Sensitivity, specificity, positive predictive value, negative predictive value, positive likely hood ratio, negative likely hood ratio between peripheral perfusion index and hypotension by constructing a receiver operating characteristic curve (ROC curve)

METHODOLOGY

STUDY TITLE

"Correlation between Peripheral Perfusion index measured by Pulse oximeter and Blood pressure in neonates more than 35 weeks of gestational age."

STUDY DESIGN

Prospective observational study (diagnostic test)

STUDY CENTER

Department of Neonatology, Institute of Child Health & Hospital for Children, Chennai, Tamilnadu.

DURATION OF STUDY

November 2013 to march 2014

MATERIALS & METHODS

Subjects

Neonates more than 35 weeks of completed gestation age admitted to Neonatology department and who need hemodynamic monitoring.

Inclusion criteria

Neonates more than 35 weeks of completed gestation age admitted to Neonatology department and who need hemodynamic monitoring in conditions like shock, hypoglycemia, Perinatal asphyxia, respiratory distress, seizure and sepsis.

Exclusion criteria

Major Congenital Anomaly

Life Threatening Heart Disease Diagnosed in the Antenatal period

Sample Size

The number of measurements needed to define a sensitivity of 90%, a specificity of 80% in a 30% incidence of perfusion abnormality and 95% confidence interval was 461 measurements.

Procedure

Neonates who were more than 35 weeks admitted to the nursery and who needed hemodynamic monitoring were enrolled into the study in the presence of investigator after getting consent (Annexure 2) from parents. After recruitment baseline data were entered in the data entry form (Annexure 3)

Agreement between the investigator and the senior consultant in

assessing shock was ensured before recruitment of babies.

Gestation age was assigned to baby either by first trimester ultra sonogram dating or Last menstrual period.

Hemodynamic monitoring was done by the investigator for the recruited neonates for 48 hours from the time of enrollment; the temperature of the baby displayed in the warmer was recorded during hemodynamic monitoring.

The monitoring included the following clinical parameters;

- Heart rate, pulse volume, capillary refill time, cold extremities
- Measurement of blood pressure (systolic, diastolic and mean pressure)
- Recording of perfusion index by using a pulse oximeter

Time schedule for Monitoring

- For all recruited babies every 8^{th} hourly from the time of recruitment to 48 hours.
- In shock babies every twenty minutes till perfusion is normal and thereafter as scheduled.

Heart rate monitoring

Heart rate measurement was done by investigator using stethoscopes when the baby is not agitated.

Extremities cold to touch

Using the dorsum of the hands the temperature was felt in the abdomen and the foot of the neonate If both the abdomen and foot were warm, then the neonate was normothermic and if the abdomen was warm and the foot was cold to touch then the neonate was cold stress / may be in shock.

Pulse volume monitoring

Central pulse –The strength of brachial pulse & femoral pulse was assessed.

Peripheral pulse –The strength of radial pulse & posterior tibial pulse was assessed.

Capillary refill time

After the application of a blanching pressure in the chest for 3-5 seconds, time taken for the return of color was assessed.

Blood pressure measurement

Blood pressure was measured in supine position with an appropriate size cuff (Figure – 3) in a quiet environment, in the right upper limb, when the baby was not agitated [(14)]. The instrument used was a Nihon kohden multichannel monitor (Figure – 2). The width of the cuff was 60 to 70% of the arm length.

Figure: 2 Nihon kohden multichannel monitor

Figure: 3 Different size Blood pressure cuff

Perfusion index recording

Perfusion index reading was obtained from the display of pulse oximeter with signal extraction technology. The measurement was taken from right upper limb after a gentle application of the pulse oximeter probe, when the limb is at rest and without agitation –Masimo radical 7 pulse oximeter (Figure – 4) was used.

Figure: 4 Masimo pulse oximeter

Clinical criteria to define Shock / Poor perfusion;

Weak & fast pulse (Heart Rate >180/min)

Capillary Refill Time >3 Sec

Extremities cold to touch

With or without the following signs:

Lethargy, not arousable on stimulation , very pale

Hypotension was defined as mean blood pressure value below the 10th Centile line corresponding to the gestational age and postnatal age of the baby in blood pressure chart. (Annexure 5) Treatment of the primary condition, shock and choice of inotropes was as per unit policy.

DATA COLLECTION

All the data collected through individual case records were transferred to the Excel sheet.

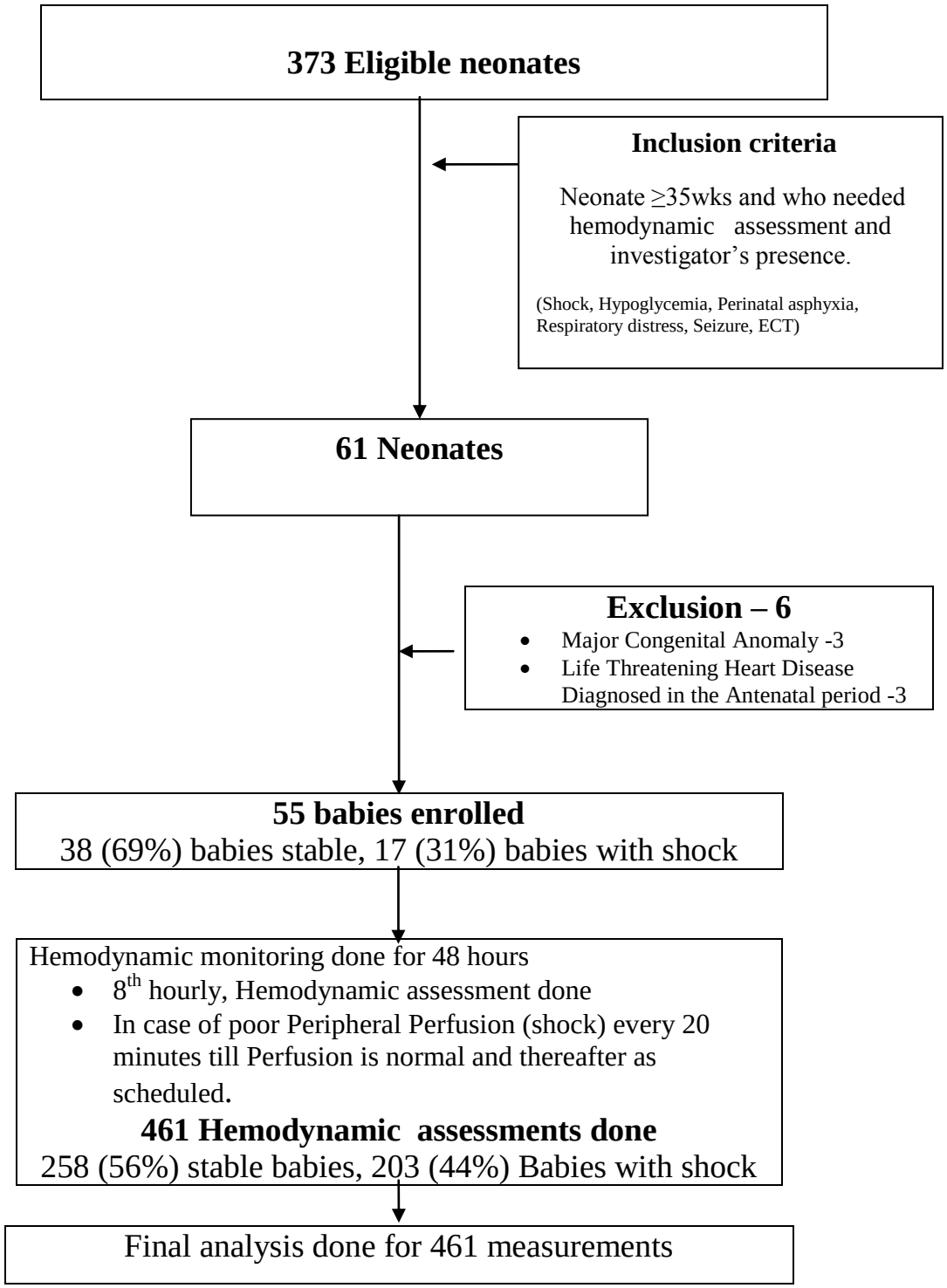
DATA ANALYSIS

SPSS software was used for analysis of the results.

The correlation coefficient between perfusion index and blood pressure was calculated by using Spearman's Correlation coefficient as the perfusion index observed had a skewed distribution.

Receiver operating characteristic curve (ROC curve) was constructed to predict clinical shock from perfusion index and hypotension from perfusion index.

Flow of the study



OBSERVATION AND RESULTS

A total of 373 neonates more than 35 weeks were admitted to the Department of Neonatology, of which 61 neonates fulfilled the inclusion criteria. After excluding three malformation and three antenatally diagnosed complex congenital heart diseases, a total of 55 neonates were enrolled into the study. Incidence of shock in enrolled babies was 31%.

A total of 461 hemodynamic assessments were done for the 55 enrolled neonates. 258 (56%) measurements were performed on hemodynamically stable babies and 203 (44%) measurement was done on babies who had poor perfusion.

Neonatal Demographic features

In our study, male babies (54.5%) were more than girl babies. More Sick babies were admitted in late neonatal period (Median days 10). The percentage of babies born by vaginal route was 64% and 40% of babies were delivered in a level I care center. 52.9% of the babies with shock had been referred from tertiary care units. 30% of the sick babies did not receive safe transport. (Table – 4)

Table: 4 Neonatal Demographic features

Characteristics	**All babies (55)**	**Babies with shock (17)**
Male: Female	1.2 : 1 (30, 25)	1.83 : 1(11, 6)
Mean Birth weight (grams)	2777.24±547.948	2726.35±391.98
Mean GA (weeks)	38.07±1.562	38.35±1.579
Mode of delivery		
Normal vaginal	35(64%)	12(70.6%)
Instrumental	6(11%)	2(11.8%)
LSCS	14(25%)	3(17.6%)
Place of delivery		
Level I	22(40%)	6(35.3%)
Level II	13(24%)	2(11.8%)
Level III	20(36%)	9(52.9%)
Mode of transport		
Government (N108,G108) ambulance	22(40%)	4(23.5%)
Private ambulance	19(35%)	8(47.1%)
Others	14(25%)	5(29.4%)
Median days of life on admission And interquartile range	2(1,19)	10(1,19.5)

Morbidity pattern

Our study population had heterogeneous clinical problems, Among recruited babies sepsis, Perinatal hypoxia, congenital heart disease, respiratory problem, Vitamin K dependent bleeding disorder, dehydration, IDM, Prematurity and IUGR were the common morbidity observed. Sepsis and asphyxia were the predominate morbidity seen in babies with shock. (Table – 5)

Table: 5 Morbidity pattern

Morbidity	**Total babies enrolled 55 babies**	**Babies with shock 17 babies**
SEPSIS	10 (18%)	7(41%)
Congenital heart disease	9 (16.3%)	3(18%)
Asphyxia	13(21.8%)	5(29.4%)
Respiratory morbidity	10(18%)	1(5.8%)
Malformations	1 (1.8%)	1(5.8%)

Vital parameters

The vital parameter analysis in babies with shock showed the following observations; The mean heart rate was 161 bpm, mean diastolic pressure of 43 mm of Hg, Mean pulse pressure of 24 mm of Hg and a Mean temperature of 36.3^0C. The median perfusion index is 0.82. (Table -6)

Table: 6 Vital parameters

Hemodynamic assessment	**Total babies enrolled 55 babies (461 assessments)**	**Babies with shock 17 babies (203 assessments)**
Mean Temperature (celsius)	36.45 ± 0.42	36.37 ± 0.62
Mean Heart rate (bpm)	154± 22	161 ± 25
Mean Systolic blood pressure (mm of Hg)	68 ± 11	67 ± 13
Mean Diastolic pressure (mm of Hg)	39 ± 11	43 ± 12
Mean Arterial pressure (mm of Hg)	50 ± 10	51 ± 12
Mean Pulse pressure (mm of Hg)	28 ± 8	24 ± 8
Perfusion index Median & interquartile range	1.3(0.83, 2.75)	0.820 (0.48,1.2)

Distribution of Perfusion index

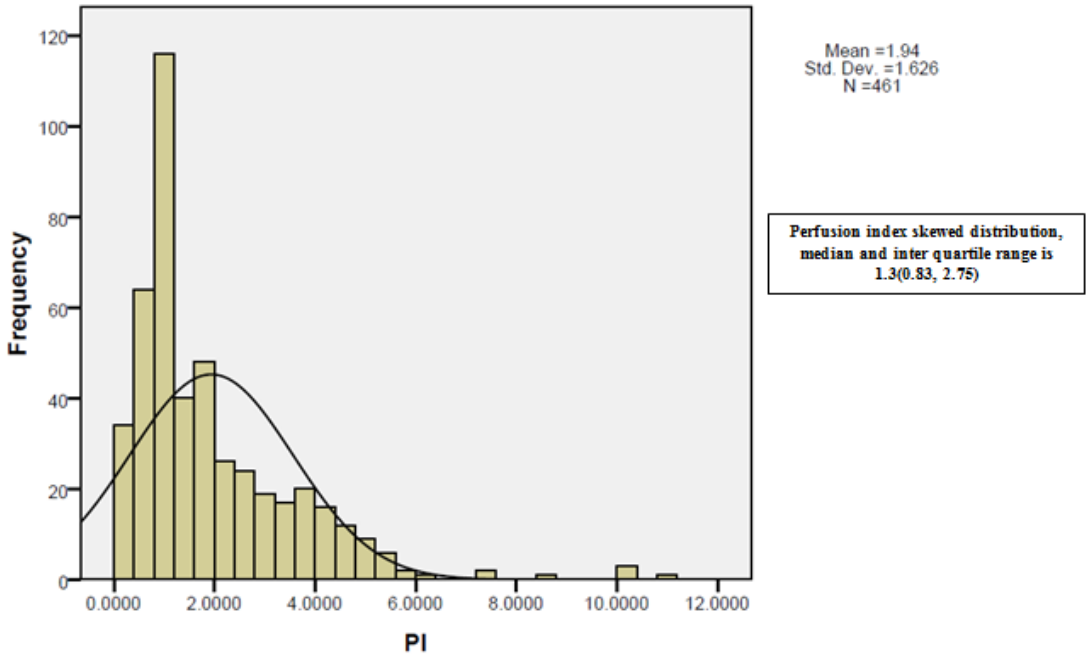


Figure: 5 Skewed distribution of perfusion index

The perfusion index has a skewed distribution with a median of 1.3 and an interquartile range of 0.83 – 2.75 (Figure 5). Maximum and minimum perfusion index recorded in the study was 11 and 0.23 respectively.

Primary outcome

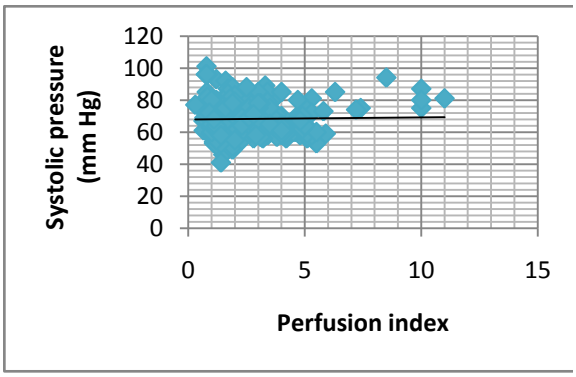
Table: 7 Correlation coefficient between perfusion index and blood pressures

Correlation		Spearman's rho correlation coefficient	Interpretation
Perfusion index	Systolic blood pressure	- 0.183 (P = 0.01)	Very weak negative correlation
Perfusion index	Diastolic blood pressure	-0.519 (P = 0.01)	Moderate negative correlation
Perfusion index	Mean arterial pressure	-0.353 (P = 0.01)	Weak negative correlation
Perfusion index	Pulse pressure	0.517 (P = 0.01)	Moderate positive correlation

In our study, perfusion index had a skewed distribution; hence non parametric test Spearman rho correlation was used.

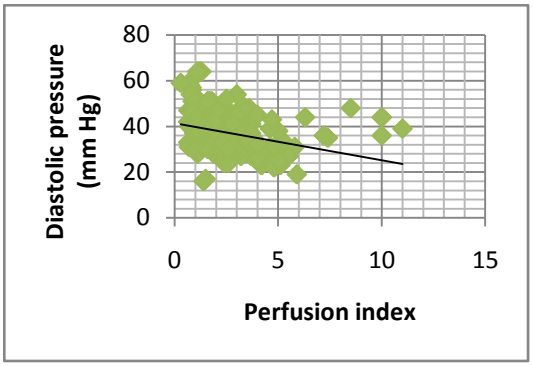
Perfusion index had a negative correlation with blood pressures, but the strength of negative correlation varies. There existed a very weak negative correlation / no correlation with Systolic blood pressure, moderate negative correlation with diastolic blood pressure and weak negative correlation with mean arterial pressure (Table – 7). But, the Perfusion index had a positive (moderate) correlation with Pulse pressure (Figure – 6).

Scatter diagram between perfusion index and blood pressure



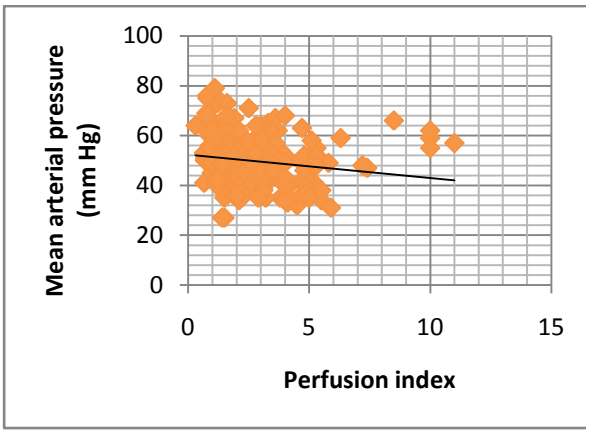
Correlation between Perfusion index and Systolic blood pressure

VERY WEAK NEGATIVE CORRELATION



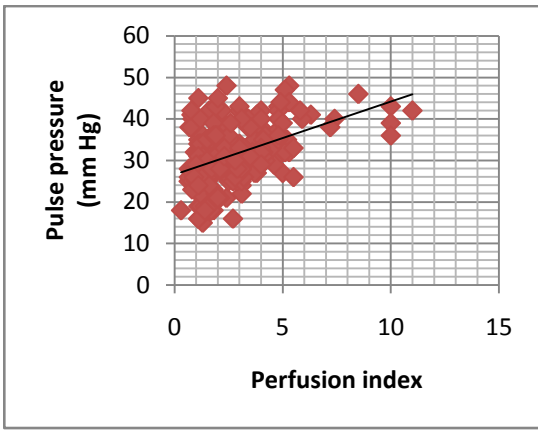
Correlation between Perfusion index and Diastolic blood pressure

MODERATE NEGATIVE CORRELATION



Correlation between Perfusion index and Mean arterial pressure

WEAK NEGATIVE CORRELATION



Correlation between Perfusion index and Pulse pressure

MODERATE POSITIVE CORRELATION

Figure: 6 Correlation between perfusion index and blood pressure

Prediction of clinical shock by perfusion index (constructing ROC curve)

Receiver operating characteristic curve (ROC curve) was constructed (Figure – 7) to predict clinical shock from perfusion index. Area under the curve was 0.930 with a narrow confidence interval (Table – 8).

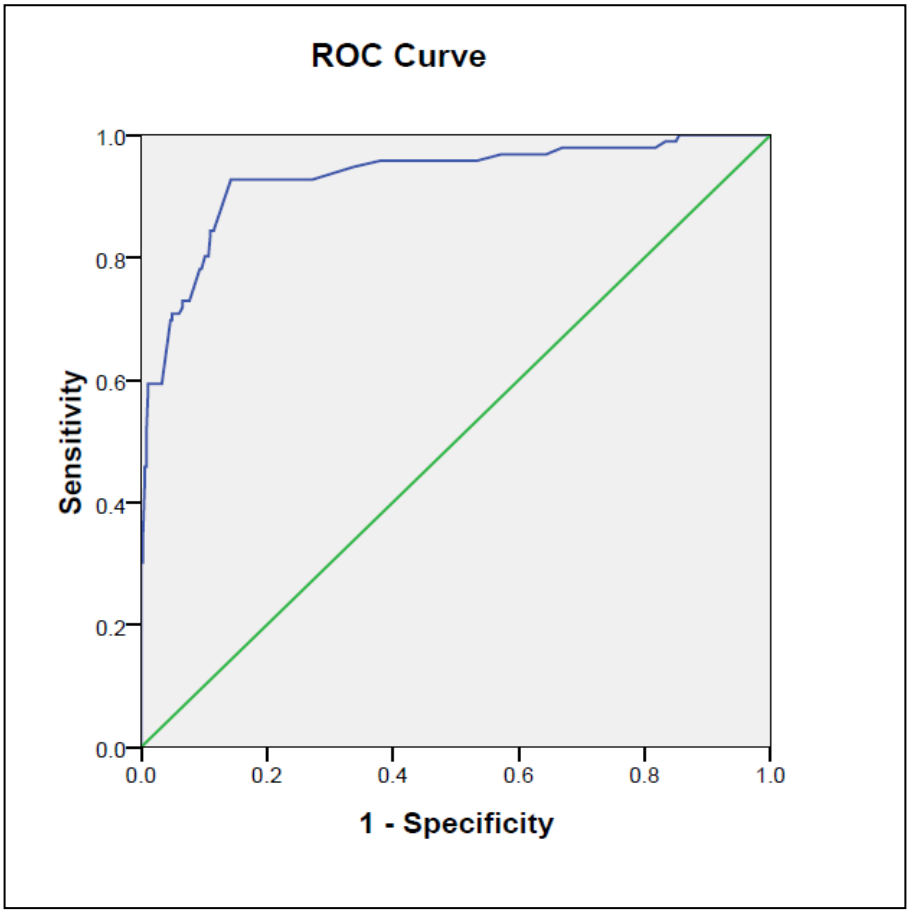


Figure: 7 ROC curve, prediction of clinical shock by perfusion index

Table: 8 Area under the Curve

AREA	STD.ERROR	95% CONFIDENCE INTERVAL	
		Lower limit	Upper limit
0.930	0.017	0.898	0.963

The cut off for high sensitivity and low false positive in the coordinates (Table – 9) of the ROC curve is 0.91.

Table : 9 Coordinates of the Curve

Positive if less than or equal to	Sensitivity	1 - specificity
0.795	0.729	.077
0.805	0.781	0.093
0.815	0.781	0.096
0.825	0.802	0.101
0.835	0.802	0.107
0.845	0.833	0.110
0.860	0.844	0.110
0.885	0.844	0.115
0.910	**0.927**	**0.142**
0.930	0.927	0.145
0.945	0.927	0.148
0.960	0.927	0.153
0.975	0.927	0.159
0.990	0.927	0.162
1.050	0.927	0.208

We constructed a 4 x 4 table (Table – 10) by taking perfusion index less than 0.91 as an index test and clinical assessment of shock as a reference test.

Table: 10

Reference test →	**Shock**		
Index test	**Present**	**Absent**	
Perfusion index < 0.91	89	52	141
Perfusion index > 0.91	7	313	320
	96	365	461

Table: 11 Perfusion index < 0.91 in predicting shock

Sensitivity	93%
Specificity	86%
False positive	14%
False negative	7%
Positive predictive value	63%
Negative predictive value	97%
Positive Likelihood ratio (LR +)	6.5%
Negative Likelihood ratio (LR -)	8.4%

The perfusion index of less than 0.91 has high sensitivity of 93 %, negative predictive value of 97%, and low false positivity of 14% and false negativity of 7% in predicting shock (Table – 11).

Secondary outcome

Prediction of hypotension by perfusion index (constructing ROC curve)

Receiver operating characteristic curve (ROC curve) was constructed (Figure – 8) to predict hypotension from perfusion index. Area under the ROC curve was 0.612 with a narrow confidence interval (Table – 12).

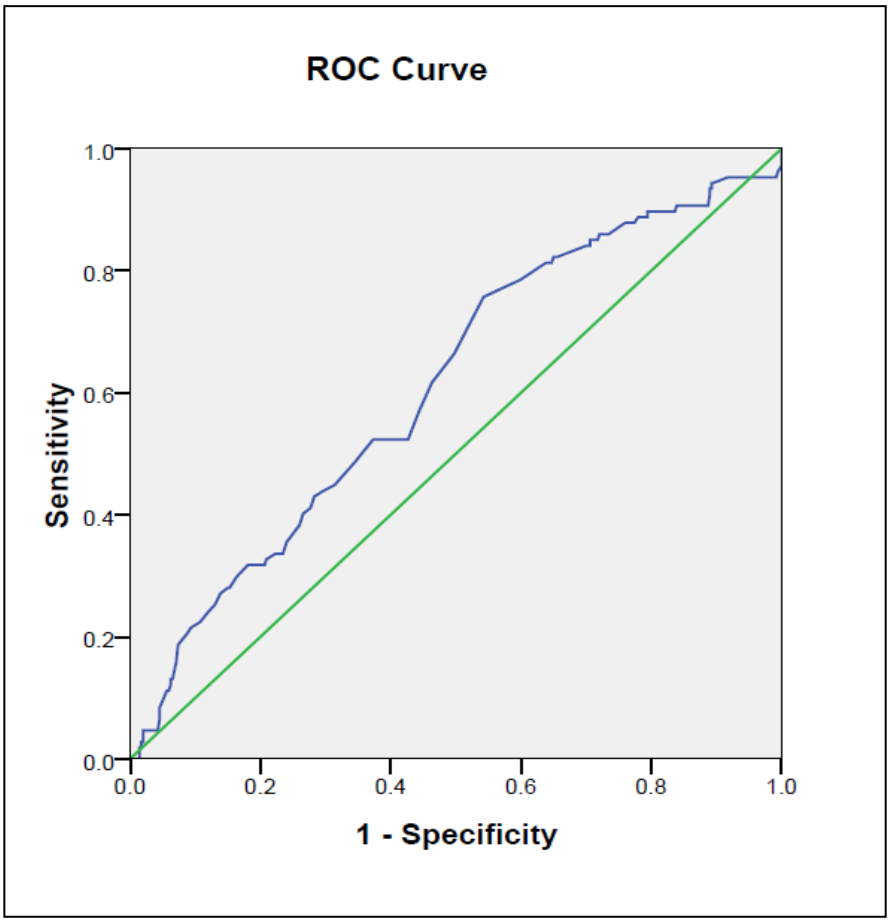


Figure: 8 ROC curve, prediction of hypotension by perfusion index

Table: 12 Area under the Curve

AREA	STD.ERROR	95% CONFIDENCE INTERVAL	
		Lower limit	Upper limit
0.612	0.031	0.552	0.673

Area under the ROC curve is small and the coordinates of the curves (Table – 13) show high sensitivity and high false positivity.

Table: 13 Coordinates of the Curve

Positive if less than or equal to	Sensitivity	1 - specificity
.235000	.991	1.000
.245000	.972	1.000
.255000	.963	.994
.270000	.953	.992
.285000	.953	.989
.295000	.953	.983
.305000	.953	.958
.315000	.953	.952
.335000	.953	.944
.345000	.953	.932
.355000	.953	929

The cutoff value in the coordinates of the ROC curve for high sensitivity to predict hypotension by perfusion index is less than 0.335 (Table – 13). Perfusion index is unreliable in predicting hypotension.

The percentage decrease in perfusion index in predicting future shock

Receiver operating characteristic curve (ROC curve) was constructed (Figure – 9) to predict shock from a percentage change in perfusion index. Area under the ROC curve was 0.660 which is small (Table – 14).

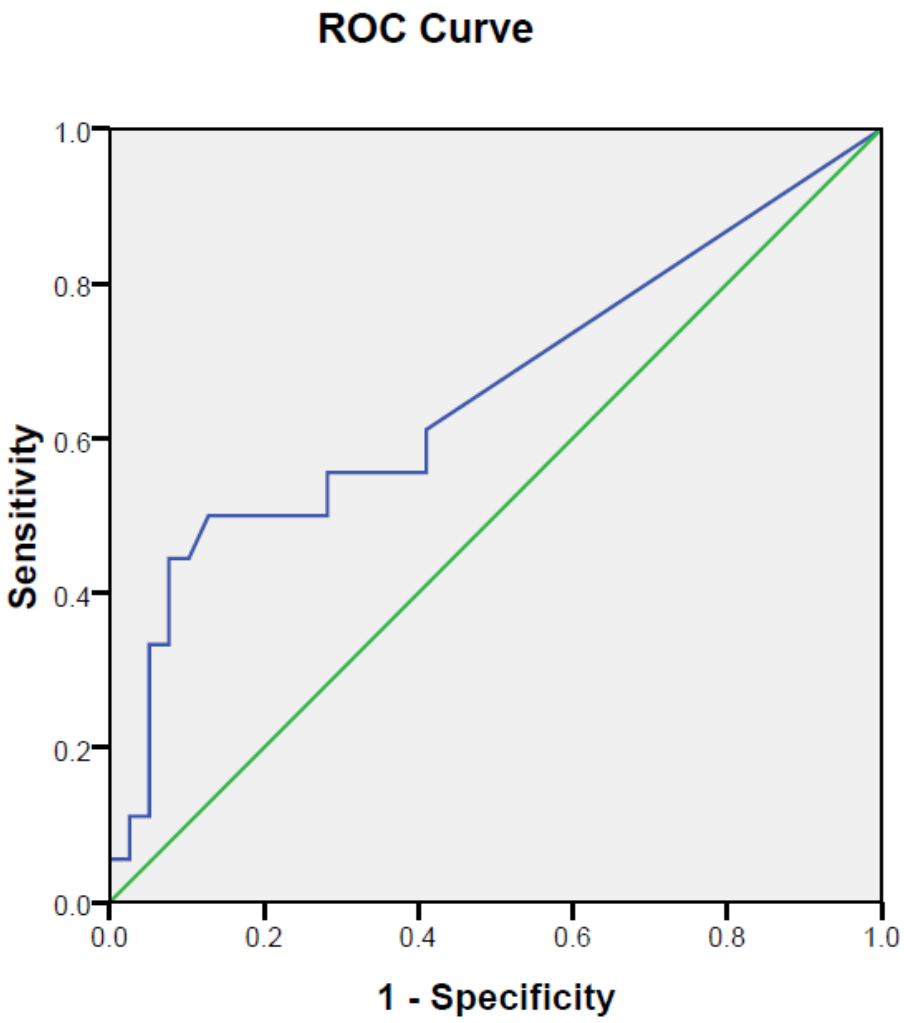


Figure: 9 ROC curve, prediction of latter shock by change in perfusion index

Table: 14 Area under the Curve

AREA	STD.ERROR	95% CONFIDENCE INTERVAL	
		Upper limit	Lower limit
0.660	0.084	0.494	0.825

The coordinates of the curves (Table – 15) show low sensitivity and high false positivity.

Table: 15 Coordinates of the Curve

Positive if less than or equal to	Sensitivity	1 - specificity
1.400000	0.611	.410
3.200000	0.556	.410
5.500000	0.556	.333
6.200000	0.556	.308
7.700000	0.556	.282
9.650000	0.500	.282
11.750000	0.500	.231
14.150000	0.500	0.205
15.950000	0.500	0.179
18.300000	**0.500**	**0.128**
21.250000	0.444	0.103

The cutoff value in the coordinates of the ROC curve to predict shock is an 18 % decrease in perfusion index.

DISCUSSION

Our study was conducted to ascertain whether there is a correlation between blood pressure and perfusion index and also to study whether Perfusion Index (PI) can predict shock in neonates.

Correlation between perfusion index and blood pressure

We were the first to study the correlation between blood pressure and perfusion index in neonates. Perfusion index in our study had a skewed distribution with a median of 1.3 and inter quartile ranges of 0.83 and 2.75. The same finding was recorded by two other authors. **LIMA AP, et al** [9] in their study involving adults recorded a skewed distribution in perfusion index, median perfusion index was 1.4 (1.15), **Francesco Cresi, et al** [23] recorded perfusion index in preterm which was also skewed.

Spearman's rho correlation was used to analyze the correlation between perfusion index and blood pressure as the PI had a skewed distribution.

In our study, we found a negative correlation between perfusion index and systolic, diastolic blood pressures and mean arterial blood pressure. The negative correlation was very weak between systolic blood pressure and perfusion index (r = -0.183). Generally Perfusion index

increases proportionately when the cardiac output increases and it decreases when the vascular resistance increases. Systolic blood pressure is dependent on cardiac output. Hence perfusion index is expected to increase when systolic blood pressure increases (direct correlation). On the contrary, we had a very weak negative correlation between perfusion index and systolic blood pressure in our study. This may be due to our study population; One third proportion of our babies had a poor peripheral perfusion state (31%). During shock sympathetic over activity causes an increase in cardiac output (systolic blood pressure), heart rate and peripheral vasoconstriction (diastolic blood pressure). Thus the increased vascular tone decreases perfusion index, in spite of elevated cardiac output. (Systolic blood pressure), This might explain the very weak negative correlation we observed in our study.

In case of low perfusion state the sympathetic compensatory mechanism increases the peripheral vascular resistance and that results in increased diastolic pressure and decreased blood flow. So we expect the perfusion index to be less in this situation. In our study, we observed a negative correlation (r = -0.519) between perfusion index and diastolic blood pressure, which is consistent with other studies done by **Yamada et al** [(8)]. In their study, they used perfusion index for assessing vasoconstriction response during tracheal intubation in the adult

population. They found that during tracheal intubation perfusion index decreases, while diastolic pressure, mean blood pressure and heart rate increase (negative correlation).

Mean arterial blood pressure is diastolic pressure plus 1/3rd of pulse pressure, which again depends mainly on diastolic pressure, so as diastolic pressure increases mean arterial blood pressure also increases. So we expect a negative correlation between perfusion index and mean arterial pressure. In our study also we had a weak negative correlation (r=-0.353) between mean arterial blood pressure and perfusion index.

The Pulse pressure is the difference between systolic and diastolic blood pressure. Increased pulse pressure is seen in hyper dynamic conditions and cardiac shunt lesions. Decreased Pulse pressure is seen in the compensated phase of shock. In our study, we established a moderate positive correlation (r=0. 517) between perfusion index and pulse pressure, which is consistent with studies by **Patrizia Zaramella et al** [(11)]**.** They found that there is a positive correlation between the Perfusion index and Blood flow (r=0. 32, p=0. 03) and perfusion index not only predicts poor perfusion (Low PI) but may also identify hyper dynamic states (high PI) like patent ductus arteriosus (PDA) and shunt lesions.

All blood pressure measurements were non invasive (NIBP). A question might be raised about the method of blood pressure

measurement. Though invasive blood pressure (IBP) is an accepted method, it was not ethical in our study as we included at risk newborns who needed monitoring. Only 31% of our population had a shock. Not all of them needed invasive blood pressure monitoring. Study by Meyer et al [22] showed good agreement between NIBP and IBP, hence measurement of BP by noninvasive method may be a more pragmatic approach.

Perfusion index as a predictor of shock

There are no studies in the literature using perfusion index (PI) to predict shock in neonates. Previous studies have looked at using Perfusion Index for predicting the severity of illness and detecting low SVC flow in the neonates.

In our study, we constructed ROC curve to predict shock by perfusion index. The cutoff value of PI less than 0.91 predicts shock in at risk neonates. The perfusion index of less than 0.91 has high sensitivity of 93 %, negative predictive value of 97%, and low false positivity of 14% and false negativity of 7% in predicting shock. In the study by **De Felice C, et al** [21] perfusion index of 0.86 ± 0.26 predicted high illness severity (SNAP score) in the neonate with high sensitivity. **S, Takahashi et al** [19] found a positive correlation between perfusion index and SVC flow and predicted low SVC flow in preterm neonates with the Perfusion index less than 0.44. In a study done by **Lima AP, et al** [9] in the adult population, the

perfusion index of 1.4 indicated poor peripheral perfusion.

Perfusion index as a predictor of hypotension

In our study, we constructed ROC curve to predict hypotension by perfusion index (PI). The cutoff value of PI less than 0.355 predicts hypotension in at risk neonates. Prediction of hypotension by perfusion index is not reliable because of more false positivity. As the sample size calculated is not based on hypotension, we could not get the best correlation.

Perfusion index as predictor of future shock in at risk neonates

Perfusion index (PI) is an indicator of vasoconstriction. So a decrease in perfusion index indicates increase in sympathetic tones which occur in many conditions like pain, stress and in shock. In our study, we constructed ROC curve to predict future shock by percentage of change in perfusion index (PI). We found an 18% decrease in perfusion index from the baseline in at risk babies predicts future shock. This result should be interpreted cautiously because pain, stress and hypothermia also decrease the PI.

STRENGTHS AND LIMITATIONS OF THE STUDY

STRENGTHS OF THE STUDY

- In this study all the hemodynamic assessments were performed by a single investigator. Inter observer variability is eliminated.
- Standardized protocol and reliable equipments were used for hemodynamic monitoring and blood pressure measurement.
- In this study the incidence of babies estimated to have shock was same as that used for sample size calculation. So the interpretation of the results was statistically significant.

LIMITATIONS OF THE STUDY

- Some of assessments were done later than stipulated time.

CONCLUSION

- Clinical shock in neonates can be reasonably predicted when perfusion index is less than 0.91.
- Perfusion index less than 0.91 has high sensitivity and low false positivity in predicting clinical shock.
- No correlation between systolic blood pressure and perfusion index, negative correlation with diastolic blood pressure (moderately negative) and mean arterial blood pressure (weak negative).
- Pulse pressure had positive correlation with perfusion index
- An 18% decrease of perfusion index from the baseline, may predict future shock. States like pain, stress, hypothermia also decreases perfusion index.
- Perfusion index is unreliable in predicting hypotension

Implication for practice

Perfusion index displayed in newer pulse oximeters may be a useful added parameter for the assessment of peripheral perfusion. The best cutoff for the prediction of poor perfusion is less than 0.91 in neonates.

Implication for research

1. A larger study with larger sample size might be needed, to get more insight about the perfusion index and its prediction of impending illness.

2. To study the Correlation between perfusion index and invasive blood pressure in sick neonates.

3. To study the role of perfusion index in detecting patent ductus arteriosus (PDA) in preterm.

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Annexure 1

INFORMATION SHEET

- We are conducting a study on "Correlation between Peripheral Perfusion index measure by Pulse oximeter and Blood pressure in Neonated more than 35 wks of Gestation". For this your approval and consent may be valuable to us.
- Need for study- In order to have a screening test(perfusion index) that reflects low blood pressure measurement
- The purpose of the study is to asses correlation between the Peripheral perfusion index & blood pressure in newborn ≥35 wks and prediction of hypotension by perfusion index
- We are selecting the babies based on eligibility criteria and other treatments shall be uniform according to hospital protocol
- Eligible babies are – neonates more than 35 wks need hemodynamic monitoring (shock, hypoglycemia, perinatal asphyxia, respiratory distress, seizure, sepsis)
- Intervention- blood pressure measurement by non invasive oscillometric method , peripheral perfusion index measurement by pulse oximeter – non invasive and clinical assessment of shock for 48 hrs
- Adverse events- no adverse effect (non invasive test)

- Safety measures- strict aseptic precaution will be taken while assessing shock clinically, measuring blood pressure and peripheral perfusion index
- The participation is voluntary and after your consent, you are free to withdraw from the study whenever you desire and there shall be no compulsion involved, other treatments and benefits shall not be affected by your decision not to participate
- The privacy of the patients in the research will be maintained throughout the study. In case of any publication or presentation resulting from research no personally identifiable information shall be shared
- Taking part in the study is voluntary. you are free to participate in the study or withdraw at any time, your withdrawal shall not result in any loss of benefits which you are otherwise entitled The results of the study will be intimated to you at the end of the study period.

Signature of the investigator Signature of the parents

Date :

Place :

ஆராய்ச்சி தகவல் தாள்

தலைப்பு:

இரத்த அழுத்தத்திற்கும் இரத்த ஒட்ட அளவையென்னுக்கும் (பெர்ப்யூசன் இன்டெக்ஸ்) இடையே உள்ள சம்மந்தத்தை 35 வாரத்திற்கு மேல் பிறக்கும் குழந்தைகளிடம் கண்டறிதல்.

மூச்சுத்திணறல், வலிப்பு, கிருமித்தாக்கம், பிறந்த உடன் அழுவாது இருத்தல், இரத்தத்தில் சர்க்கரை குறைதல் மற்றும் இரத்த ஒட்டம் குறைதல் போன்ற குழந்தைகளுக்கு இரத்த ஒட்ட கண்காணிப்பு தேவைப்படும்.

இந்த ஆய்வின் மூலம் போது மேற்கூறிய பாதிப்புகள் உள்ள குழந்தைகளை 48 மணி நேரம் தீவிரமாக கண்காணித்து அப்போது குழந்தையின் இரத்த ஒட்டம், இரத்த அழுத்தம், இரத்த ஒட்ட அளவு எண் போன்றவற்றை மருத்துவ பரிசோதனை, இரத்த அழுத்தம் பார்க்கும் கருவி மற்றும் பல்ஸ் ஆக்சி மீட்டர் போன்றவற்றின் மூலம் தேவைக்கேற்ப பதிவு செய்யப்படும்.

இந்த ஆய்வில் உட்படுத்தப்படும் குழந்தைகளின் மருத்துவ சிகிச்சை பிற குழந்தைகளின் மருத்துவ சிகிச்சையிலிருந்து எவ்வித வேறுபாடும் இருக்காது. இந்த ஆய்வின் நோக்கம் இரத்த அழுத்தத்திற்கும் இரத்த ஒட்ட அளவையென்னுக்கும் (பெர்ப்யூசன் இன்டெக்ஸ்) இடையே உள்ள சம்மந்தத்தை 35 வாரத்திற்கு மேல் பிறக்கும் குழந்தைகளிடம் கண்டறிந்து அதன் மூலம் குறைந்த இரத்த அழுத்தத்தினை முன் கூட்டியே இரத்த ஒட்ட அளவை எண் மூலம் கண்டறிதல்.

உங்கள் குழந்தையை, இந்த ஆய்வில் பங்குபெறச் செய்தால் எங்களுக்கு மகிழ்ச்சி அளிக்கும். இந்த ஆய்வில் தங்கள் குழந்தைக்கு எவ்வித பாதிப்பும் நேராது என நாங்கள் உறுதி கூறுகிறோம். இந்த ஆய்வில் பங்கு பெற்றே தீர வேண்டும் என்று எந்தவொரு கட்டாயமும் இல்லை.

இந்த ஆய்வில் எந்தவொரு நிலையிலும், ஆய்விலிருந்து தாங்கள் விலகலாம். இதனால், தங்கள் குழந்தைக்கு இரத்த ஒட்டம் சீரடையச் செய்யும் மருத்துவ சிகிச்சையில் எந்த மாற்றமும் இருக்காது என உறுதி கூறுகிறேன்.

தனி நபர் குறித்த அனைத்து விவரங்களும், ஆய்வின் முடிவுகளும் ரகசியமாகப் பாதுகாக்கப்படும். ஆய்வின் முடிவு, ஆய்வு முழுமையாக நிறைவு பெற்ற பிறகு தங்கள் விருப்பத்தின் பேரில் தெரிவிக்கப்படும்.

ஆய்வாளர் கையொப்பம்
பெயர் :
நாள் :

பெற்றோர்/பாதுகாப்பாளர் கையொப்பம்
பெயர் :
நாள் :

Annexure 2

CONSENT FORM

I Ms/Mr._____ M/O//F/O,B/O _____ Sex_____Hosp. No._____ admitted in the Neonatal ward of ICH Egmore Chennai, was explained by the doctor that mybaby need hemodynamic monitoring. I am willing for my child to be enrolled in the study Titled **"Correlation between Peripheral Perfusion index measured by Pulse oximeter and Blood pressure in Neonates more than 35wks of Gestation"** . The doctors have explained to me the nature and the purpose of the study. I have given my consent only after completely understanding the details that were explained to me and have read the information sheet for the study .I am willing for my baby to be enrolled in this study without any ones compulsion and I am fully aware that I can withdraw from the study at any time during the study. I have given consent for monitoring blood pressure, peripheral perfusion index and clinical assessment of for shock, as per the study protocol. I have given this consent to be enrolled in this study with my full consciousness**.**

Signature of Investigator **Signature of Parent**

ஆராய்ச்சி ஒப்புதல் சான்று

ஆராய்ச்சி தலைப்பு

இரத்த அழுத்தத்திற்கும் இரத்த ஒட்ட அளவையென்னுக்கும் (பெர்ப்யூசன் இன்டெக்ஸ்) இடையே உள்ள சம்மந்தத்தை 35 வாரத்திற்கு மேல் பிறக்கும் குழந்தைகளிடம் கண்டறிதல்.

குறித்த ஆய்வு.

பெயர் :
த/பெ. :
பால் :

தேதி :
உள்நோயாளி எண் :
ஆராய்ச்சி சேர்க்கை எண் :

குழந்தையின் உடல்நிலை குழந்தைக்கு தொடர்ச்சியாக இரத்த ஒட்டத்தை கண்காணிப்பதின் அவசியமும் மருத்துவரால் முழுமையாக நான் நன்றாக புரிந்து கொள்ளும்படி விளக்கப்பட்டது.

இந்த ஆய்வு குறித்த தகவல் தாளை மருத்துவர் மூலம் பெற்றுக் கொண்டேன். இந்த ஆய்வின் நோக்கமும், ஆய்வு குறித்த விளக்கமும் மருத்துவரால் எனக்கு தெளிவாக விளக்கப்பட்டது. இந்த ஆய்வு பற்றிய விவரங்களை முழுமையாகப் புரிந்து கொண்ட பிறகே, இந்த ஆய்வில் பங்குபெற சம்மதிக்கிறேன்.

நான் இந்த ஆய்வில், எவரின் கட்டாயமும் இன்றி, முழு சுதந்திரத்துடன் பங்கு பெற சம்மதிக்கிறேன். இந்த ஆய்வின் எந்த நிலையிலிருந்தும், நான் ஆய்விலிருந்து விலகலாம் என்பதையும் நான் அறிவேன்.

நான் எனது குழந்தையின் உடலிலுள்ள இரத்த அழுத்த பரிசோதனைக்கும், இரத்த ஒட்ட குறைபாட்டிற்கான மருத்துவ பரிசோதனைக்கும் மற்றும் பல்ஸ் ஆக்ஸ் மீட்டர் மூலம் இரத்த ஒட்ட அளவு எண்ணை கண்காணிப்பதற்கும் என் முழு சுய நினைவுடன் இந்த ஆராய்ச்சிக்கு ஒப்புதல் அளிக்கிறேன்

ஆய்வாளர் கையொப்பம்
பெயர் :
மொபைல் :
நாள் :

பெற்றோர்/பாதுகாப்பாளர் கையொப்பம்
பெயர் :

நாள் :

Annexure 3

Monitoring chart

PID :	Phone number	
IP/OP. NO :	EDD	D / M / Y ___ /___ /___
Name :	Date of birth	___ /___ /___
Sex	Date of admission	___ /___ /___
Age	Reason for referal	
Gestation age ____Wks ____Days		
Birth weight		
Present weight		
Antinatal data	**Intra/ post partum data**	
Mother name	Duration of labour	
Age : Blood group :	Induction of labour	
P/L/D/A	Mode of delivery	
Married since	Place of delivery	
Consanqunity	Resuscitation detail	
Maternal complication	Apgar	
Drug intake in pregnency	Mode of transport	
	Support during transport	
Risk for sepsis(AIIMS score)	Pre admission treatment	
Antenatal USG	Provitional diagnosos	
	Co-Morbid condition	

Perfusion index vs Blood pressure

Monitoring chart

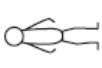
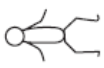
Date							
Time							
Temperature							
Prior treatment							
Cry							
Movement							
Respiratory rate							
Cynosis							
Grunting							
Retraction							
Air entry							
Heart rate							
Pulse -femoral							
Pulse -radial							
Central CRT							
cool peripheries							
Systolic BP							
Diastolic BP							
Mean BP							
Pulse pressure							
Perfusion index							
Shock/No shock							
Treatment							
If ventilated MAP							
Final diagnosis							

Perfusion index vs Blood pressure

Annexure 4

New Ballards Score

NEUROMUSCULAR MATURITY

	−1	0	1	2	3	4	5
Posture							
Square window (wrist)	 >90°	 90°	 60°	 45°	 30°	0°	
Arm recoil		 180°	 140°–180°	 110°–140°	 90°–110°	 <90°	
Popliteal angle	 180°	 160°	 140°	 120°	 100°	 90°	 <90°
Scarf sign							
Heel to ear							

PHYSICAL MATURITY

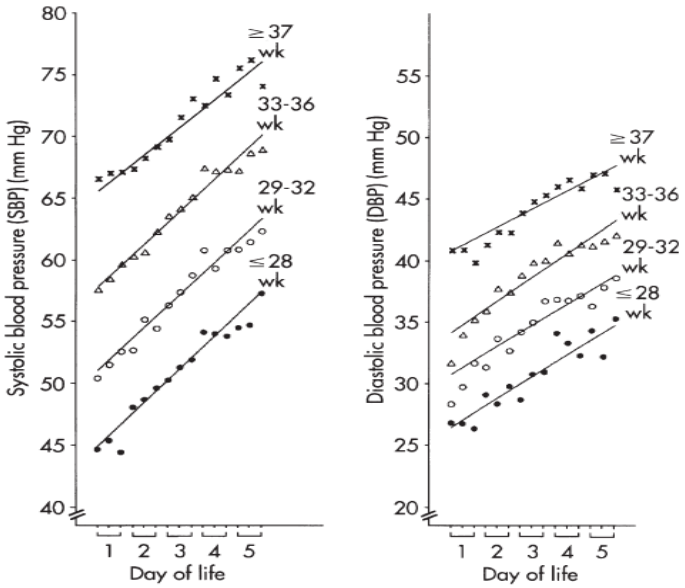
Skin	Sticky, friable, transparent	Gelatinous red, translucent	Smooth pink, visible veins	Superficial peeling and/or rash, few veins	Cracking pale areas, rare veins	Parchment, deep cracking, no vessels	Leathery, cracked, wrinkled
Lanugo	None	Sparse	Abundant	Thinning	Bald areas	Mostly bald	
Plantar surface	Heel–toe 40–50 mm: −1 <40 mm: −2	>50 mm no crease	Faint red marks	Anterior transverse crease only	Creases ant. 2/3	Creases over entire sole	
Breast	Imperceptible	Barely perceptible	Flat areola, no bud	Stippled areola 1–2 mm bud	Raised areola 3–4 mm bud	Full areola 5–10 mm bud	
Eye/ear	Lids fused loosely: −1 tightly: −2	Lids open; pinna flat, stays folded	Sl. curved pinna; soft; slow recoil	Well-curved pinna; soft but ready recoil	Formed and firm instant recoil	Thick cartilage, ear stiff	
Genitals, male	Scrotum flat, smooth	Scrotum empty; faint rugae	Testes in upper canal; rare rugae	Testes descending; few rugae	Testes down; good rugae	Testes pendulous; deep rugae	
Genitals, female	Clitoris prominent, labia flat	Prominent clitoris, small labia minora	Prominent clitoris, enlarging minora	Majora and minora equally prominent	Majora large, minora small	Majora cover clitoris and minora	

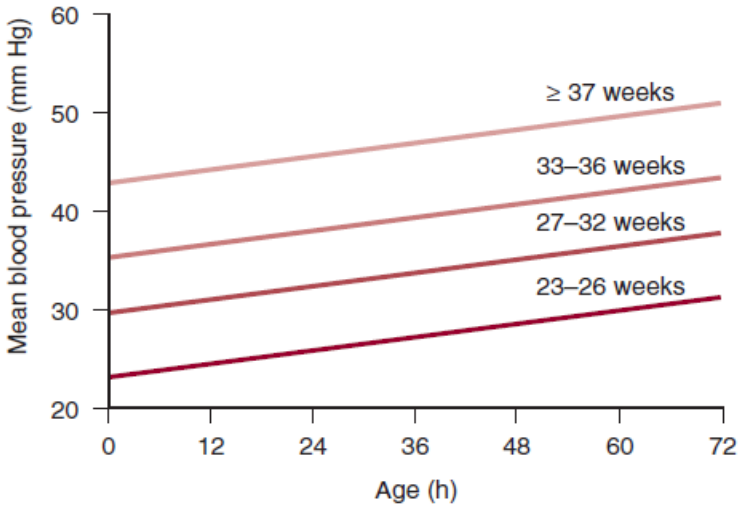
Maturity Rating

Score	Weeks
−10	20
−5	22
0	24
5	26
10	28
15	30
20	32
25	34
30	36
35	38
40	40
45	42
50	44

Annexure 5

Blood pressure chart





Annexure 6

Definition for certain terminology used in study

Perinatal asphyxia defined as APGAR < 7 at 1 minute (15)

Hypoglycemia is defined as Capillary blood glucose < 40mg/d (16)

Respiratory distress – DOWNES SCORE >1

Seizure - A seizure is defined clinically as a paroxysmal alteration in neurologic function, i.e. motor, behavior and/or autonomic function (15)

Sepsis - Neonatal sepsis is a clinical syndrome characterized by signs and symptoms of infection with or without accompanying bacteremia in the first month of life. It encompasses various systemic infections of the newborn such as septicemia, meningitis, pneumonia, arthritis, osteomyelitis, and urinary tract infections (15)

Annexure 7

Interpretation of correlation coefficient

Value of Correlation Coefficient	Correlation
0.00 to 0.19	Very Weak
0.2 to 0.39	Weak
0.40 to 0.59	Moderate
0.60 to 0.79	Strong
0.80 to 1.0	Very Strong

baby	birthwe	present	sex	MOD	POD	MOT	PRETRE	PID	GAV	DOA	DOL	TEMP	HR	F.P	P.P	CRT	SBP	HT	DBP	HT	MAP	HT	P.PRE	PI	SHOC	SPO2	mean A	TREAT	DIAGNOSE		treatment	
b/o sathya	2900	3100	1	1	4	1	3,4	112014	38	26	26	36.5	196	P	P	P	63	P	31	P	41	P	32	1.3	A	79	10.9	1,4	MAS,PPN		P= PRESENT	
												36.5	200	P	P	P	86	A	34	P	48	A	52	1.5	A	84					A= ABSENT	
												36.5	197	P	P	P	62	P	31	P	42	P	31	0.95	A	87					1-DOPA	
												36.5	198	P	P	P	58	P	32	P	41	P	27	1.2	A	85					2-DOBU	
											27	36.5	212	P	A	A	87	A	59	A	76	A	28	0.28	P	83					3-ADRENA	
												36.5	199	P	P	P	57	P	37	P	46	P	20	1	A	84					4-SILDEN	
												36.5	216	P	A	A	84	A	56	A	66	A	28	0.3	P	89					5-NS	
												36.5	195	P	P	P	77	A	49	A	58	A	28	0.87	A	81					6- HYDROCORTISONE	
												36.5	164	P	P	P	74	P	40	A	51	A	34	0.35	A	85						
b/o priya	3400	3140	1	1	1	1	2	212014	38	10	10	36.5	192	P	A	A	80	A	54	A	66	A	26	0.4	P	70	15.2	1,2,3,4	CDH, PPHN		prehospital treatment	
												36.5	160	P	A	A	85	A	52	A	67	A	33	0.4	P	99					1-nil	
											11	36.5	136	P	P	P	64	P	43	P	48	A	21	0.4	A	13					2-oxygen	
												36.5	110	A	A	A	0	P	0	P	0	P	0	0.25	P	45					3-ionotropes	
												36.5	126	A	A	A	0	P	0	P	0	P	0	0.24	P	56					4-ventillation	
												36.5	116	A	A	A	0	P	0	P	0	P	0	0.23	P	23						
												36.5	114	A	A	A	0	P	0	P	0	P	0	0.26	P	12					mode of transport	
b/o tamilara	2910	2910	1	1	4	1	2,3	312014	38	1	1	33.5	212	P	A	A	79	A	53	A	63	A	26	0.41	P	96	NO	NO	HIE 2		1-n108	
												33.5	127	P	P	P	64	A	38	P	40	P	26	0.44	A	99		1,2			2-G108	
												33.5	127	P	A	A	58	P	32	P	38	P	26	0.46	P	98					3-pvt amb	
											2	33.5	146	P	A	A	63	P	34	P	47	A	29	0.46	P	98					4-others	
												33.5	212	P	A	A	79	A	59	A	61	A	20	0.48	P	98						
												33.5	152	P	A	A	71	A	46	A	54	A	25	0.51	P	96					place of delivery	
												33.5	133	P	P	P	54	A	37	P	44	A	17	0.54	A	100					1-PHC	
												33.5	160	P	P	P	72	P	46	A	52	A	26	0.57	A	96					2-corporation	
												33.5	165	P	P	P	67	A	30	P	36	P	37	0.58	A	98					3-GH	
b/o saranya	2310	2150	2	3	5	3	2	412014	36	1	1	36.5	195	P	P	P	77	A	38	A	46	A	39	0.6	A	96	11.2	0,1,2	SEPSIS		4-medical college	
												36.5	148	P	P	P	55	A	28	P	37	A	27	3.7	A	90		1,2			5- private hosp	
												36.5	139	P	P	P	74	A	54	A	62	A	20	0.6	A	96		0,1,2			6-home	
												36.5	148	P	A	P	74	A	43	A	56	A	31	0.6	P	97		0,1,2				
											2	36.5	212	P	A	A	83	A	57	A	64	A	26	0.6	P	97		1,2,3				
												36.5	134	p	p	p	60	A	37	A	45	A	23	0.6	A	97		1,2,3				
												36.5	146	P	P	P	55	A	33	A	43	A	22	0.6	A	97		1,2,3				
												36.5	168	P	P	P	70	A	39	A	48	A	31	0.9	A	96		1,2,3			mod	

												36.5	164	P	P	P	62	A	29	P	47	A	33	2.3	A	95		1,2,3			1-nvd	
												36.5	123	P	P	P	65	A	40	A	50	A	25	1.6	A	95		NO			2-instrument	
b/o deepika	3500	3300	2	1	1	4	1	512014	40	19	19	36.5	125	P	P	P	65	P	38	P	46	P	27	5	A	96	HOOD	NO	BP		3-LSCS	
												36.5	145	P	P	P	81	A	33	P	55	A	48	5.3	A	96		NO				
												36.5	150	P	P	P	75	A	43	A	56	A	32	3.2	A	96		NO			sex	
											20	36.5	140	p	p	p	71	A	41	A	50	A	30	2.7	A	99		NO			1-boy	
												36.5	146	p	p	p	73	A	42	A	50	A	31	2.5	A	99		NO			2-girl	
												36.5	145	P	P	P	69	A	39	P	50	A	30	4.6	A	96		NO			3-DSD	
B/0 RAVANA	3100	3150	1	1	1	3	2	612014	39	4	4	36.5	134	P	P	P	67	P	42	A	53	A	25	0.65	A	96	HOOD	NO	HIE 2			
												36.5	161	P	P	P	60	P	27	P	41	P	33	2.5	A	96		1			HT-hypotension	
												36.5	163	P	P	P	64	P	40	A	42	P	24	3.1	A	96		1				
											5	36.5	165	P	P	P	74	A	43	A	57	A	31	2.8	A	96		1				
												36.5	144		p	p	69	P	40	A	51	A	29	0.95	A	98		1				
											6	36.5	148		p	p	68	P	40	A	50	A	28	1.9	A	97		1				
												36.5	152		p	p	72	A	38	P	53	A	34	2.1	A	98		1				
kamesh	3000	3180	1	3	3	4	1	712014	38	26	26	36.5	173	P	P	P	80	A	43	A	63	A	37	4.7	A	17	HOOD	NO	DORV			
												36.5	159	P	P	P	66	P	38	P	46	A	28	2.5	A	11		NO				
												36.5	150	P	P	P	48	P	31	P	35	P	17	1.5	A	48		NO				
											27	36.5	148	P	P	P	66	P	31	P	45	P	35	3.7	A	63		NO				
												36.5	152	P	P	P	64	P	30	P	38	P	34	2.5	A	70		NO				
												36.5	150	P	P	P	65	P	31	P	34	P	40	2.1	A	72		NO				
b/osuryakal	2750	4050	1	1	1	4	1	812014	38	19	19	36.5	169	P	P	P	65	P	43	A	55	A	22	3.1	A	100	NO	NO	SEPSIS			
												36.5	179	P	P	P	81	A	46	A	57	A	35	2.5	A	100		NO				
												36.5	151	P	P	P	81	A	41	A	62	A	40	3.7	A	98		NO				
											20	36.5	131	P	P	P	85	A	44	A	59	A	41	6.3	A	97		NO				
												36.5	140	p	p	p	75	A	35	P	47	P	40	7.4	A	98		N0				
												36.5	142	p	p	p	74	A	36	P	48	P	38	7.2	A	97		NO				
b/o sudha	3300	3210	2	1	3	1	2	912014	40	2	2	36.5	50	P	P	P	53	P	27	P	34	P	26	5.5	A	97	HOOD	NO	HEART BLOCK			
												36.5	50	P	P	P	59	P	19	P	31	P	40	5.9	A	96		NO				
B/O REMA D	3000	3160	2	1	3	3	2	1012014	39	15	15	36.5	151	P	P	P	59	P	33	P	44	P	26	2.4	A	96	NO	NO	ACHD			
												36.5	152	P	P	P	64	P	36	P	48	P	28	2.8	A	95		NO				
												36.5	148	P	P	P	68	P	35	P	45	P	33	2.6	A	97		NO				
											16	36.5	154	P	P	P	70	P	30	P	50	A	40	3.2	A	97		NO				
												36.5	162	P	P	P	72	P	38	P	42	P	32	2.2	A	98		NO				

												36.5	172	P	P	P	70	P	30	P	52	A	40	3.4	A	96		NO				
b/o rameeja	3000	2510	2	1	3	3	2	1512014	38	25	25	36.5	131	P	P	P	79	A	43	A	54	A	36	1.9	A	96	NO	NO	hie3			
												36.5	108	P	P	P	70	A	40	P	54	A	30	1.7	A	97		NO				
												36.5	138	P	P	P	84	A	42	A	54	A	42	2.2	A	95		NO				
												36.5	140	P	P	P	74	A	40	P	55	A	34	2.5	A	96		NO				
												36.5	153	P	P	P	76	A	42	A	59	A	34	2.8	A	95		NO				
											26	36.5	193	P	P	P	79	A	64	A	74	A	15	1.3	A	96						
												36.5	170	P	P	P	93	A	64	A	73	A	29	1.2	A	95						
												36.5	164	P	P	P	77	A	51	A	60	A	26	0.87	A	97						
b/o sarala	2015	2015	2	3	1	1	2	1212014	38	1	1	36.5	153	P	P	P	61	P	33	P	41	A	28	0.66	A	96	HOOD	NO	IUGR			
												36.5	136	P	P	P	73	A	47	A	63	A	26	0.66	A	96		NO				
												36.5	110	P	P	P	69	A	31	P	50	A	38	0.69	A	97		NO				
											2	36.5	195	P	P	P	68	A	40	A	51	A	28	0.7	A	97		NO				
												36.5	170	P	P	P	61	P	45	A	55	A	16	1.1	A	95		NO				
												36.5	183	P	P	P	79	A	48	A	58	A	31	1.4	A	95		NO				
												36.5	157	P	P	P	70	A	48	A	58	A	22	1.7	A	96						
												36.5	138	P	P	P	70	A	43	A	56	A	27	1.3	A	95						
b/o vanitha	3000	3060	1	2	1	1	2	1612014	39	1	1	36.5	143	P	P	P	59	P	41	A	52	A	18	1.8	A	97	CPAP 5	NO	TTN			
												36.4	139	P	P	P	60	P	44	A	47	A	16	2.7	A	97		NO				
											2	36.5	131	P	P	P	63	P	45	A	53	A	18	1.7	A	97		NO				
												36.5	164	P	P	P	56	P	27	P	40	A	29	2.8	A	96		NO				
												36.5	160	P	P	P	62	P	24	P	38	P	38	2.4	A	96		NO				
b/o inthuma	3035	2870	2	1	4	3	2,3	1312014	40	17	17	36.3	154	P	A	A	67	A	35	P	39	P	32	0.8	P	94	NO	5,2	LOS			
												36.5	192	P	A	A	48	P	32	P	30	P	16	1.2	P	94		1,2				
												36.4	152	P	A	A	77	A	39	P	59	A	38	1.2	P	97		1,2				
												36.5	100	P	A	P	60	P	33	P	41	P	27	1.3	P	95		1,2,3				
												36.5	136	P	P	A	56	P	37	P	42	P	19	1.9	P	97	8.4	1,2,3				
												36.5	160	P	A	A	65	P	30	P	47	P	35	2.5	P	96		2				
												36.5	160	P	A	A	75	A	37	P	52	A	38	3.7	P	95		2				
												36.5	179	P	P	P	68	A	43	A	51	A	25	5	A	96		2				
												36.6	180	P	P	P	57	P	33	P	41	P	24	4.2	A	95		2				
											18	36.8	179	P	P	P	55	P	33	P	41	P	22	3.9	A	97		2				
												36.5	179	P	P	P	55	P	30	P	36	P	25	3.7	A	95		2				
												36.6	179	P	P	P	55	P	32	P	40	P	23	3.8	A	96		2				

												36.5	179	P	P	P	56	P	33	P	39	P	23	3.6	A	96		2				
												36.5	178	P	P	P	59	P	31	P	40	P	28	3.5	A	95		2				
												36.6	177	P	P	P	54	P	30	P	38	P	24	3.5	A	96		2				
b/o masthan	2500	2750	1	1	1	4	1	1112014	40	13	13	36.6	136	P	P	P	71	A	46	A	58	A	25	0.81	A	70	6.7		TA,PA				
												36.5	200	P	P	P	61	P	36	P	43	P	25	0.83	A	70							
												36.5	102	P	P	P	59	P	39	P	42	P	20	0.85	P	51		2				
												36.5	130	P	P	P	65	P	35	P	45	P	30	1.1	A	51						
												36.4	137	p	p	p	73	A	42	A	54	A	31	1.4	A	69						
												36.6	138	p	p	p	69	P	39	P	53	A	30	1.3	A	56						
											14	36.6	143	p	p	p	68	P	39	P	49	P	29	1.1	A	71						
												36.5	148	p	p	p	75	A	47	A	57	A	28	0.57	A	68						
												36.5	147	p	p	p	74	A	46	A	62	A	28	0.58	A	65						
												36.8	146	p	p	p	68	P	41	A	48	P	27	0.62	A	59						
												36.7	157	p	p	p	68	P	48	A	58	A	20	1.8	A	59						
												36.7	158	p	p	p	83	A	47	A	58	A	36	2	A	63						
												36.7	162	p	p	p	72	A	48	A	62	A	24	1.9	A	69						
b/o KAMALA	2800	2950	2	3	5	3	2	5522014	38	19	19	36.5	136	P	P	P	79	A	52	A	64	A	27	1.1	A	96	5		HIE 3				
												37.2	165	P	P	P	89	A	49	A	65	A	40	3.3	A	97						
												37.4	163	P	P	P	80	A	48	A	67	A	32	3.6	A	100						
												36.9	171	P	P	P	85	A	47	A	62	A	38	3.4	A	96						
												36.6	165	P	P	P	85	A	54	A	64	A	31	3	A	98						
											20	36.5	138	P	P	P	92	A	50	A	66	A	42	1.6	A	98						
												36.5	136	P	P	P	72	A	45	A	59	A	27	1.9	A	98						
b/o latha	2400	2200	2	3	5	3	2	1822014	39	2	2	36.5	138	P	P	A	80	A	67	A	74	A	13	0.9	P	98	HOOD	2	HIE2				
												36.5	136	P	P	A	55	P	35	P	51	A	20	0.82	P	98		2				
												36.5	146	P	P	A	80	A	69	A	70	A	11	0.6	P	98						
												36.5	152	P	P	P	88	A	68	A	72	A	20	0.9	A	97		2				
												36.5	148	P	P	A	60	P	42	A	54	A	18	0.5	P	98		2				
												36.5	168	P	P	P	62	P	38	A	52	A	26	0.92	A	96		2				
												36.5	172	P	P	P	63	A	40	A	50	A	23	1	A	95		1,2				
											3	36.5	168	P	P	A	70	A	52	A	54	A	18	0.6	P	98		1,2				
												36.5	148	P	P	P	69	A	48	A	52	A	21	1	A	97		1,2				
												36.5	152	P	P	A	68	A	50	A	54	A	18	0.8	P	95		1,2				
												36.5	162	P	P	P	70	A	35	P	40	P	35	1.2	A	97		1,2				

												36.5	138	P	P	P	85	A	51	A	70	A	34	2.1	A	97							
b/ogomathy	2500	2410	2	1	1	3	2	1412014	39	2	2	36.5	141	P	P	P	54	P	33	P	42	A	21	1.7	A	97		O	ACHD						
											3	36.5	146	P	P	P	48	P	28	P	37	P	20	1.9	A	98		O							
												36.5	140	P	P	P	50	P	29	P	37	P	21	1.8	A	96	CPAP 5	5,1							
												36.5	149	P	A	A	60	P	37	P	46	A	23	3.9	P	95		1							
												36.5	137	P	P	P	60	P	41	A	50	A	29	2.1	A	97		1							
												36.5	132	P	P	P	61	P	38	P	52	A	23	1.6	A	98		1							
											4	36.5	134	P	P	A	71	A	43	A	55	A	28	0.36	P	96		1,2							
												36.5	134	P	P	A	75	A	43	A	55	A	32	0.34	P	97		1,2							
												36.5	133	P	P	A	74	A	46	A	57	A	28	0.4	P	98		1,2							
sakthi	2700	3220	1	1	4	4	1	1712014	37	29	29	36.5	148	P	P	P	68	P	39	A	46	P	29	1.2	A	100	HOOD		ALCAPA						
												36.5	148	P	P	P	64	P	36	P	47	P	28	1.5	A	98									
												36.5	147	P	P	P	64	P	32	P	42	P	32	1.8	A	97									
												36.5	148	P	P	P	67	P	34	P	45	P	33	1.4	A	96									
												36.5	150	P	P	P	63	P	36	P	42	P	27	1.8	A	95									
											30	36.5	138	P	P	P	65	P	37	P	48	P	28	1.3	A	96									
												36.5	148	P	P	P	78	A	33	P	51	A	45	1.1	A	95									
b/o harpitha	2700	3110	2	1	1	4	1	1922014	37	20	20	36.5	193	P	P	A	65	P	52	A	57	A	13	0.84	P	100	HOOD	2	ACHD						
												36.5	200	P	P	A	78	A	51	A	56	A	27	0.6	P	95		2							
												36.6	197	P	P	A	79	A	47	A	57	A	32	0.4	P	98		2							
												36.4	196	P	P	A	66	P	48	A	60	A	18	0.37	P	96		2							
											21	36.6	208	P	P	A	64	P	53	A	58	A	9	0.3	P			1,2							
												36.4	199	P	P	A	76	A	50	A	54	A	26	0.7	P			1,2							
												36.5	203	P	P	P	77	A	48	P	56	A	29	0.8	A			1,2							
b/o nishanth	1490	1555	1	2	1	1	2	2022014	37	1	1	36.6	136	P	P	P	54	P	28	P	45	A	26	1.1	A	98	NO		iugr/hypoglycemia						
												36.5	134	P	P	P	59	P	30	P	45	A	29	0.97	A	97									
												36.5	142	P	P	P	60	P	31	P	46	A	29	1.2	A										
											2	36.6	138	P	P	P	64	A	39	P	49	A	25	1.3	A										
												36.5	136	P	P	P	66	A	31	P	48	A	35	1.1	A										
												36.4	134	P	P	P	65	A	30	P	51	A	35	1.6	A										
b/o vasanth	2600	2600	2	1	5	3	2	2122014	36	1	1	36.5	146	P	A	A	64	A	48	A	52	A	16	0.5	P	97	HOOD	5	SEPSIS						
												36.5	152	P	A	A	68	A	48	A	52	A	20	0.5	P	96		5							
												36.5	148	P	P	A	72	A	49	A	51	A	23	0.4	P	95		1							
												36.5	176	P	P	A	70	A	46	A	50	A	24	0.6	P	98		1,2							

												36.5	148	P	P	P	71	A	40	A	46	A	31	0.8	A			1,2								
												36.5	152	P	P	P	70	A	35	A	48	A	35	1	A											
												36.5	168	P	P	P	75	A	40	A	46	A	35	1	A											
												36.5	154	P	P	P	72	A	41	A	46	A	31	1.2	A											
												36.5	173	P	P	P	74	A	36	A	45	A	38	1.3	A											
											2	36.5	164	P	P	P	76	A	40	A	46	A	36	1.6	A											
												36.5	132	P	P	P	73	A	41	A	43	A	32	1.4	A											
												36.5	148	P	P	P	72	A	38	A	42	A	34	1.8	A											
b/o reenuka	3100	3400	1	1	1	4	1	2222014	40	27	27	36.5	186	P	A	A	80	A	58	A	59	A	22	0.4	P	95	MAP 8	5	SEPSIS						
												36.5	194	P	A	A	83	A	56	A	60	A	27	0.3	P	96		5							
												36.5	188	P	A	A	92	A	58	A	59	A	34	0.3	P	95		1							
												36.5	193	P	A	A	72	A	60	A	62	A	12	0.32	P			1,2							
												36.5	190	P	A	A	73	A	58	A	59	A	15	0.31	P			2,3							
												36.5	194	P	A	A	75	A	61	A	63	A	14	0.33	P			2,3							
												36.5	196	P	A	A	79	A	64	A	65	A	15	0.38	P			2,3,6							
												36.5	194	P	A	A	70	A	60	A	62	A	10	0.34	P											
												36.5	184	P	A	A	71	A	62	A	64	A	9	0.32	P											
												36.5	174	P	A	A	70	A	58	A	60	A	12	0.29	P											
												36.5	173	P	A	A	71	A	59	A	62	A	12	0.25	P											
												36.5	154	P	A	A	71	A	58	A	60	A	13	0.25	P											
												36.5	164	A	A	A	50	P	38	A	38	P	12	0.24	P											
												36.5	168	A	A	A	56	P	40	A	41	A	16	0.26	P											
b/o nagama	2700	2440	2	3	5	3	2	2322014	38	1	1	36.5	147	p	p	p	70	A	27	P	52	A	43	4.8	A	74	MAP 9.2		CCHD						
												36.5	149	p	p	p	63	A	35	P	54	A	28	1	A											
											2	36.5	152	p	p	p	63	A	38	P	52	A	25	0.98	A											
												36.5	164	p	p	p	70	A	28	P	52	A	42	4	A											
												36.5	162	p	p	p	71	A	30	P	54	A	41	3.8	A											
												36.5	150	p	p	p	73	A	31	P	58	A	42	3	A											
b/oanitha	2050	2040	2	1	1	1	1	2422014	40	1	1	36.5	147	P	P	P	96	A	56	A	65	A	40	0.83	A	96			IUGR						
												36.5	145	P	P	P	85	A	57	A	75	A	28	0.79	A											
												36.5	144	P	P	P	82	A	57	A	67	A	25	0.82	A											
											2	36.5	153	P	P	P	101	A	60	A	76	A	41	0.78	A											
												36.5	155	P	P	P	96	A	58	A	69	A	38	0.75	A											
												36.5	148	P	P	P	96	A	54	A	68	A	42	0.78	A											

b/o munnus	3200	3600	1	1	3	4	1	2522014	35	28	28	36.5	158	P	P	P	56	P	24	P	40	A	32	5.1	A	98	MAP 6.2		BP			
												36.5	156	P	P	P	58	A	24	P	37	P	34	4.8	A							
												36.5	155	P	P	P	58	P	23	P	41	A	35	4.2	A							
												36.5	157	P	P	P	56	P	24	P	40	A	32	4.2	A							
												36.5	158	P	P	P	57	P	23	P	41	A	34	5.1	A							
												36.5	164	P	P	P	60	P	27	P	35	P	33	2.2	A							
											29	36.5	156	P	P	P	62	A	27	P	44	A	35	3.7	A							
												36.5	164	P	P	P	62	A	28	P	46	A	34	3	A							
												36.5	156	P	P	P	77	A	37	A	56	A	40	1.2	A							
												36.5	161	P	P	P	70	A	34	A	54	A	36	1.3	A							
												36.5	159	P	P	P	69	A	37	A	49	A	32	0.94	A							
b/o kannaki	2600	2450	2	3	5	4	1	2622014	38	10	10	36.5	114	P	P	P	65	A	32	P	43	P	33	1.5	A	96	NO		vasambu illius			
												36.5	112	P	P	P	58	P	32	P	38	P	26	1.4	A							
												36.5	104	P	P	P	62	P	33	P	40	P	29	1.5	A							
												36.5	122	P	P	P	66	P	34	P	45	P	32	1.1	A							
											11	36.5	121	P	P	P	64	P	33	P	41	P	31	1.2	A							
												36.5	148	P	P	P	81	A	51	A	59	A	30	1.8	A							
												36.5	148	P	P	P	87	A	51	A	66	A	36	1.7	A							
												36.5	147	P	P	P	82	A	51	A	62	A	31	1.6	A							
												36.5	146	P	P	P	79	A	47	A	60	A	32	1.5	A							
b/o dharani	2000	2100	1	1	2	1	2	2722014	36	1	1	36.5	135	P	P	P	53	P	34	A	41	A	19	1.1	A	98	CPAP 5		TTN			
												36.5	129	P	P	P	54	P	34	A	44	A	20	1.3	A							
												36.5	148	P	P	P	61	A	38	A	45	A	23	1.2	A							
											2	36.5	139	P	P	P	54	A	33	P	63	A	21	1.4	A							
												36.5	142	P	P	P	56	A	34	P	54	A	22	1.1	A							
												36.5	140	P	P	P	58	A	33	P	52	A	23	1.2	A							
b/o kumuth	3750	3770	1	1	3	2	2	2822014	36	1	1	36.5	138	P	P	P	55	A	29	P	46	A	26	1.2	A	98	NO		NNS			
												36.5	135	P	P	P	60	A	31	P	45	A	29	1	A							
												36.5	141	P	P	P	61	A	32	P	46	A	29	1.2	A							
											2	36.5	139	P	P	P	64	A	38	A	48	A	26	1.3	A							
												36.5	137	P	P	P	66	A	32	P	48	A	34	1.2	A							
												36.5	136	P	P	P	66	A	31	P	51	A	35	1.5	A							
B/O KANCHA	2750	3120	2	1	5	4	1	2922014	39	18	18	36.5	172	P	P	P	87	A	44	A	59	A	43	10	A	99	NO		Meningitis			
												36.5	165	P	P	P	81	A	39	A	57	A	42	11	A							

												36.5	162	P	P	P	75	A	36	A	55	A	39	10	A											
												36.5	160	P	P	P	80	A	44	A	62	A	36	10	A											
											19	36.5	180	P	P	P	94	A	48	A	66	A	46	8.5	A											
												36.5	172	P	P	P	46	P	17	P	27	P	26	1.5	A			5								
												36.5	170	P	P	P	41	P	16	P	27	P	31	1.4	A			1								
												36.5	164	P	P	P	74	A	27	P	58	A	47	5.1	A											
												36.5	169	P	P	P	72	A	28	P	52	A	44	5.3	A											
												36.5	163	P	P	P	73	A	31	P	49	A	42	5.8	A											
B/O PUNITH	3150	3150	1	3	5	3	1	3022014	37	1	1	36.5	138	P	P	P	60	P	31	P	35	P	29	4.6	A	96	NO		HYPOGLYCEMIA							
												36.5	152	P	P	P	58	P	28	P	40	A	30	4	A											
												36.5	146	P	P	P	59	P	31	P	42	A	28	3.8	A											
											2	36.5	154	P	P	P	60	P	25	P	41	A	35	5.2	A											
												36.5	132	P	P	P	58	P	26	P	48	A	32	5.3	A											
												36.5	156	P	P	P	59	P	27	P	40	A	32	5.1	A											
												36.5	168	P	P	P	60	P	27	P	38	P	33	5.5	A											
b/o kavitha	3000	3550	1	1	3	2	2	3122014	37	1	1	36.5	124	P	P	P	78	A	43	A	50	A	35	1.9	A	98	NO		HIE 1							
												36.5	118	P	P	P	70	A	40	A	42	A	30	1.8	A											
												36.5	128	P	P	P	84	A	41	A	54	A	43	1.9	A											
											2	36.5	146	P	P	P	74	A	40	A	55	A	39	1.8	A											
												36.5	154	P	P	P	76	A	43	A	59	A	33	1.7	A											
												36.5	132	P	P	P	78	A	43	A	73	A	35	1.6	A											
												36.5	162	P	P	P	82	A	34	P	58	A	48	2.4	A											
b/o divya	1740	1760	2	1	1	2	1	3222014	35	1	1	36.5	146	P	P	P	60	A	30	P	35	A	30	3.8	A	96	NO		Late preterm							
												36.5	152	P	P	P	58	A	28	P	34	P	30	4.2	A											
												36.5	133	P	P	P	60	A	27	P	32	P	33	4.5	A											
											2	36.5	134	P	P	P	58	A	26	P	33	P	32	4.1	A											
												36.5	152	P	P	P	62	A	27	P	36	A	35	4.8	A											
												36.5	144	P	P	P	65	A	27	P	34	P	38	4	A											
												36.5	156	P	P	P	60	A	29	P	36	A	31	4.1	A											
b/o nagavall	3400	3400	1	1	3	3	2,3	3322014	41	1	1	36.5	137	P	P	A	82	A	67	A	74	A	15	0.9	P	96	MAP .8	5	MAS							
												36.5	135	P	P	A	55	A	36	P	51	A	19	0.82	P			1								
												36.5	147	P	P	A	81	A	70	A	72	A	11	0.6	P			1,2								
												36.5	153	P	P	A	89	A	67	A	75	A	22	0.9	P			1,2								
												36.5	149	P	P	P	62	A	41	A	53	A	21	0.54	A											

												36.5	154	P	P	P	63	A	39	A	53	A	24	0.8	A											
												36.5	168	P	P	P	63	A	42	A	50	A	21	1	A											
											2	36.5	172	P	P	P	70	A	52	A	50	A	18	1.1	A											
												36.4	149	P	P	P	69	A	48	A	51	A	21	1	A											
												36.5	154	P	P	P	67	A	49	A	51	A	18	1.1	A											
												36.5	163	P	P	P	70	A	30	P	58	A	40	3.2	A											
b/o krishnap	2900	2900	1	3	5	3	2	3422014	40	1	1	36.5	137	P	P	P	69	A	42	A	54	A	27	1.2	A	97	MAP 5		HIE 3						
												36.3	146	P	P	P	79	A	39	A	55	A	40	3.4	A											
												36.5	143	P	P	P	70	A	38	A	57	A	32	3.6	A											
											2	36.4	161	P	P	P	75	A	37	P	52	A	38	3.5	A											
												36.5	165	P	P	P	75	A	44	A	54	A	31	3	A											
												36.5	139	P	P	P	72	A	40	A	56	A	32	1.2	A											
												36.5	137	P	P	P	62	A	35	P	44	A	27	3.8	A											
b/o kavitha	2000	2110	1	1	5	3	2	3522014	36	1	1	36.5	133	P	P	P	60	A	30	P	44	A	30	3.1	A	95	CPAP 5		TTN						
												36.5	134	P	P	P	58	A	28	P	45	A	30	3.4	A											
												36.6	145	P	P	P	57	A	27	P	43	A	30	3.8	A											
											2	36.8	155	P	P	P	60	A	30	P	52	A	30	3.1	A											
												36.5	160	P	P	P	60	A	32	P	48	A	28	3	A											
												36.6	165	P	P	P	63	A	35	A	50	A	28	1.2	A											
												36.5	150	P	P	P	70	A	36	A	52	A	34	1.1	A											
b/o lakshmi	2645	2660	1	1	1	1	1	3622014	37	1	1	36.5	145	P	P	P	54	P	33	P	43	A	21	1.8	A	99	NO		HDN						
												36.6	145	P	P	P	49	P	28	P	36	P	21	1.9	A											
												36.6	140	P	P	P	51	P	29	P	36	P	22	1.9	A											
											2	36.5	148	P	P	P	63	A	37	P	47	A	27	3.7	A											
												36.5	136	P	P	P	61	A	40	A	51	A	21	2.4	A											
												36.5	131	P	P	P	62	A	39	A	53	A	23	1.8	A											
												36.4	133	P	P	P	72	A	44	A	56	A	28	0.9	A											
b/o manime	3018	3800	1	2	2	4	1	3722014	39	19	19	36.6	136	P	P	P	64	P	37	P	44	A	27	0.5	A	98	MAP 9	1,2	B.P						
												36.6	162	P	P	P	73	A	47	A	51	A	26	0.56	A											
												36.5	164	P	P	P	67	P	31	P	36	P	36	0.7	A											
												36.5	195	P	P	P	80	A	38	P	48	A	42	0.9	A											
											20	36.8	148	P	P	P	54	P	27	P	37	P	27	3.4	A											
												36.7	139	P	P	P	73	A	54	A	63	A	19	0.8	A											
												36.5	155	P	A	A	77	A	46	A	56	A	31	0.6	P											

												36.5	198	P	A	A	80	A	57	A	64	A	23	0.6	P			1,2,3					
												36.5	134	p	p	p	60	P	40	A	46	P	20	0.9	A								
												36.5	149	P	P	P	55	P	30	P	45	P	25	1	A								
												36.5	147	P	P	P	72	A	42	A	50	A	30	0.9	A								
												36.5	164	P	P	P	61	P	30	P	48	P	31	0.9	A								
b/o thilagav	2920	2680	1	3	3	1	2	3822014	40	2	2	36.5	152	P	P	P	88	A	50	A	67	A	36	1.9	A	99	HOOD		Pnemothorax				
												36.5	148	P	P	P	84	A	49	A	62	A	35	1.7	A								
												36.5	146	P	P	P	80	A	45	A	54	A	35	1.5	A								
											3	36.5	140	P	P	P	52	P	33	P	40	P	19	1.2	A								
												36.5	130	P	P	P	53	P	34	P	43	P	19	1.4	A								
												36.5	147	P	P	P	61	P	39	P	44	P	22	1.2	A								
b/o rajeshw	3320	3300	1	1	5	3	2	3922014	35	1	1	36.5	160	P	P	P	61	A	27	P	43	A	34	2.3	A	98	CPAP 5		TTN				
												36.5	153	P	P	P	64	A	39	A	41	A	25	2.9	A								
												36.5	162	P	P	P	77	A	46	A	52	A	31	2.7	A								
											2	36.5	145	P	p	p	69	A	39	A	49	A	30	1.1	A								
												36.5	151	P	p	p	69	A	39	A	51	A	30	1.7	A								
												36.5	153	P	p	p	72	A	40	A	50	A	32	2	A								
b/o soni	4050	3900	2	3	5	3	2	4022014	38	1	1	36.5	150	P	P	P	68	A	46	A	57	A	22	1.9	A	99	NO		IDM				
												36.5	146	P	P	P	69	A	42	A	55	A	27	1.4	A								
												36.5	162	P	P	P	62	A	43	A	49	A	19	1.6	A								
											2	36.5	143	P	P	P	60	A	35	P	51	A	25	2.5	A								
												36.5	135	P	P	P	65	A	44	A	50	A	21	1.9	A								
												36.5	156	P	P	P	55	P	28	P	39	P	27	2.3	A								
												36.5	164	P	P	P	59	P	24	P	40	P	35	2.6	A								
ranjith	3250	3720	2	1	2	1	2	4122014	40	28	28	36.5	168	P	P	P	66	P	24	P	41	P	42	4.8	A	98	CPAP 5		VSD/ASD				
												36.5	172	P	P	P	70	P	26	P	39	P	44	4.9	A								
												36.5	165	P	P	P	59	P	23	P	41	P	36	4.2	A								
											29	36.5	170	P	P	P	60	P	25	P	40	P	35	4.1	A								
												36.5	168	P	P	P	62	P	22	P	43	P	40	4.8	A								
												36.5	166	P	P	P	60	P	27	P	35	P	33	3.2	A								
b/o ravanan	2700	2900	1	2	5	3	2	4222014	38	19	18	36.5	172	P	P	A	81	A	68	A	73	A	13	0.8	P	95	HOOD	5	SEPSIS				
												36.5	165	P	P	A	57	P	37	P	49	A	20	0.8	P			1					
												36.5	176	P	P	A	82	A	68	A	70	A	12	0.6	P			1,2					
											19	36.5	152	P	P	P	84	A	64	A	72	A	20	0.9	A								

												36.5	148	P	P	A	58	P	40	A	53	A	18	0.5	P			1,2				
												36.5	168	P	P	P	66	P	40	A	50	A	26	1	A							
												36.5	154	P	P	P	64	P	40	A	50	A	24	1.1	A							
												36.5	168	P	P	A	66	P	50	A	55	A	16	0.5	P			1,2,5				
												36.5	147	P	P	P	69	P	48	A	52	A	21	1	A							
												36.5	168	P	P	A	67	P	49	A	50	A	18	0.8	P			1,2,3				
												36.5	162	P	P	P	75	A	35	P	45	P	40	1.8	A							
												36.5	193	P	P	A	63	P	50	A	56	A	13	0.84	P							
												36.5	200	P	P	A	77	A	47	A	53	A	30	0.9	P							
												36.5	197	P	P	A	75	A	42	A	50	A	33	0.43	P							
												36.5	196	P	P	A	65	P	47	A	57	A	18	0.37	P							
												36.5	208	P	P	A	65	P	53	A	57	A	10	0.34	P							
												36.5	199	P	P	A	70	P	45	A	50	A	25	0.74	P							
												36.5	203	P	P	P	78	A	46	A	55	A	32	0.97	A							
												36.5	136	P	P	P	55	P	27	P	40	P	28	1.3	A							
b/o selvi	2050	2000	1	1	3	1	2,3	4322014	36	2	2	36.5	178	P	A	A	64	P	35	P	47	A	29	0.9	P	98	HOOD	5	sepsis			
												36.5	169	P	A	A	73	P	40	A	48	A	23	0.9	P			1				
												36.5	164	P	P	P	78	A	43	A	50	A	35	4.8	A							
											3	36.5	132	P	P	P	77	A	33	P	45	A	34	4.4	A							
												36.5	136	P	P	P	58	P	33	P	43	A	25	3.9	A							
												36.5	143	P	P	P	57	P	29	P	38	A	28	3.5	A							
												36.5	146	P	P	P	60	P	33	P	42	A	27	3.6	A							
b/o deepa	2730	2150	2	1	3	4	1	4422014	39	12	12	36.5	138	P	P	P	55	P	29	P	46	P	26	1.2	A		NO		dehydration			
												36.5	135	P	P	P	60	P	31	P	45	P	29	1	A							
												36.5	141	P	P	P	61	P	32	P	46	P	29	1.2	A							
											13	36.4	139	P	P	P	64	P	38	A	48	P	26	1.3	A							
												36.5	137	P	P	P	66	P	32	P	48	P	34	1.2	A							
												36.5	136	P	P	P	66	P	31	P	51	A	35	1.5	A							
b/o hemalat	2650	2800	1	1	4	4	1	4522014	37	25	25	36.5	133	P	P	P	59	P	26	P	34	P	33	4	A	96	NO		LOS			
												36.3	150	P	P	P	62	P	26	P	37	P	36	4.9	A							
												36.5	144	P	P	P	64	P	25	P	35	P	39	5	A							
											26	36.4	156	P	P	P	60	P	29	P	36	P	31	4.1	A							
												36.5	169	P	P	A	83	A	68	A	74	A	15	0.9	P			5				
												36.5	170	P	P	A	56	P	36	P	49	A	20	0.84	P			1				

												36.5	168	P	P	A	83	A	71	A	72	A	12	0.64	P			1,2					
												36.5	153	P	P	A	87	A	67	A	72	A	20	0.9	P			1,2					
												36.5	149	P	P	P	65	P	41	A	51	A	24	0.52	A								
												36.6	151	P	P	P	63	P	38	A	51	A	25	0.84	A								
												36.8	162	P	P	P	68	P	36	P	49	A	32	1.3	A								
												36.5	164	P	P	P	70	P	35	P	52	A	35	1.4	A								
												36.6	146	P	P	P	68	P	42	A	53	A	26	1.1	A								
												36.5	151	P	P	P	62	P	47	A	52	A	15	1.1	A								
												36.5	154	P	P	P	68	P	31	P	41	P	37	3.2	A								
												36.6	136	P	P	P	72	A	41	A	51	A	31	1.2	A								
b/o tajhufra	4300	4520	2	3	3	1	2	4622014	40	1	1	36.6	132	P	P	P	66	A	35	P	46	A	31	1.3	A	96	NO		IGDM				
												36.5	134	p	p	p	71	A	41	A	52	A	30	1.1	A								
												36.5	137	p	p	p	68	A	37	P	51	A	31	1.3	A								
												36.5	142	p	p	p	71	A	40	A	48	A	31	1.1	A								
											2	36.4	145	p	p	p	73	A	46	A	54	A	27	0.8	A								
												36.6	146	p	p	p	70	A	47	A	52	A	23	0.82	A								
												36.6	152	p	p	p	65	A	40	A	49	A	25	1	A								
												36.5	143	p	p	p	69	A	41	A	52	A	28	1.6	A								
												36.5	147	p	p	p	83	A	43	A	56	A	45	2	A								
												36.5	154	p	p	p	75	A	45	A	59	A	30	1.8	A								
												36.5	138	P	P	P	80	A	51	A	61	A	29	1.2	A								
b/o sutha	2500	2320	1	1	1	1	2	4722014	38	1	1	36.5	142	P	P	P	81		45	A	57	A	36	1.8	A	95	NO		HIE 1				
												36.5	118	P	P	P	72	A	41	A	52	A	31	1.9	A								
												36.5	129	P	P	P	79	A	43	A	50	A	36	2	A								
											2	36.5	132	P	P	P	73	A	41	A	54	A	32	2.5	A								
												36.5	142	P	P	P	75	A	40	A	57	A	35	2.6	A								
												36.5	137	P	P	P	80	A	64	A	79	A	16	1.1	A								
b/o samund	2600	2540	2	2	5	3	2	4822014	39	1	1	36.5	169	P	P	P	68	A	40	A	54	A	28	2	A	97	CPAP 5		TTN				
												36.5	173	P	P	P	76	A	46	A	57	A	30	1.5	A								
												36.5	153	P	P	P	72	A	47	A	55	A	25	1.3	A								
											2	36.5	149	P	P	P	69	A	44	A	51	A	25	1.4	A								
												36.5	151	P	P	P	68	A	40	A	54	A	28	1.7	A								
												36.5	143	P	P	P	60	A	35	P	45	A	25	2.7	A								
b/o lalitha	2000	2010	2	1	1	1	2	4922014	35	1	1	36.5	168	P	P	P	64	A	32	P	43	A	32	4	A	99	NO		PRETERM				

												36.5	173	P	P	P	58	A	33	P	39	A	25	3.1	A							
												36.5	169	P	P	P	56	A	30	P	41	A	26	3.2	A							
											2	36.5	172	P	P	P	62	A	35	A	45	A	27	3	A							
												36.5	154	P	P	P	60	A	32	P	42	A	28	3.1	A							
												36.5	156	P	P	P	59	P	31	P	37	A	28	2.2	A							
												36.5	188	P	P	P	72	A	47	A	58	A	25	1.1	A							
												36.5	200	P	P	P	64	A	38	A	42	A	26	1.2	A							
b/o sangeet	2150	2090	1	3	2	1	2	5022014	37	1	1	36.5	146	P	P	P	80	A	51	A	62	A	29	1	A	96	CPAP 5		TTN			
												36.5	156	P	P	P	85	A	45	A	68	A	40	4	A							
												36.5	138	P	P	P	68	A	47	A	62	A	21	2.1	A							
											2	36.5	168	P	P	P	71	A	45	A	64	A	26	2.8	A							
												36.5	161	P	P	P	88	A	52	A	71	A	36	2.5	A							
												36.5	148	P	P	P	75	A	51	A	68	A	24	1.6	A							
b/o agalya	2175	2175	1	3	5	3	2	5132014	40	1	1	36.5	183	P	A	A	77	A	59	A	64	A	18	0.3	P	94	MAP 8	5	MAS			
												36.5	188	P	A	A	55	P	37	P	45	P	18	0.4	P			5				
												36.5	204	P	A	A	86	A	58	A	69	A	28	0.3	P			1				
												36.5	189	P	P	P	75	A	46	A	59	A	29	1	A			1				
												36.5	179	P	P	P	76	A	40	A	55	A	36	2	A			1				
												36.5	189	P	A	A	81	A	55	A	67	A	26	0.3	P			5,1				
												36.5	173	P	A	A	85	A	52	A	67	A	33	0.3	P			1,2				
												36.5	148	P	P	P	68	A	40	A	51	A	28	0.6	A							
											2	36.5	132	P	A	A	90	A	79	A	82	A	11	0.31	P			5,2,3				
												36.5	148	P	A	A	93	A	75	A	80	A	18	0.29	P			2,3				
												36.5	116	P	P	A	76	A	63	A	74	A	13	0.34	P			2,3,6				
												36.5	114	P	A	A	88	A	68	A	75	A	20	0.4	P			5,2.3				
												36.5	212	P	A	A	79	A	53	A	63	A	26	0.3	P							
												36.5	127	P	P	A	66	P	35	P	43	P	31	0.42	P							
												36.5	134	P	A	A	52	P	30	P	38	P	22	0.46	P							
												36.5	146	P	A	A	61	P	36	P	49	A	25	0.5	P							
												36.5	212	P	A	A	68	P	49	A	58	A	19	0.48	P			5				
												36.5	152	P	A	A	72	A	42	A	55	A	30	0.5	P							
												36.5	133	P	P	P	65	P	40	A	52	A	25	0.9	A							
												36.5	160	P	P	P	70	A	45	A	50	A	25	1	A							
												36.5	165	P	P	P	72	A	33	P	45	P	39	0.8	A							

b/o rani	2700	2900	1	1	3	4	1	5232014	39	7	7	36.5	145	P	P	P	69	P	48	A	58	A	21	1.1	A		NO		VASAMBU			
												36.5	134	P	P	P	78	A	42	A	52	A	36	1.9	A							
												36.5	182	P	P	P	72	A	46	A	55	A	26	0.9	A							
											8	36.5	128	P	P	P	68	P	44	A	51	A	24	1.1	A							
												36.5	132	P	P	P	58	P	40	A	49	P	18	1.4	A							
												36.5	156	P	P	P	75	A	32	P	55	A	43	3	A							
b/olatha	2340	2340	2	1	1	1	2	5322014	38	1	1	36.5	144	P	P	P	68	A	35	P	46	A	33	3	A	97	NO		HIE 1			
												36.5	156	P	P	P	78	A	38	P	56	A	40	3.1	A							
												36.5	132	P	P	P	65	A	34	P	46	A	31	3.5	A							
											2	36.5	146	P	P	P	61	P	32	P	49	A	29	4	A							
												36.5	139	P	P	P	57	P	29	P	38	P	28	3.1	A							
												36.4	145	P	P	P	67	P	31	P	46	A	36	4.8	A							
												36.5	139	P	P	P	58	P	30	P	35	P	28	2.9	A							
b/o saritha	3400	3520	2	2	2	1	2	5422014	39	1	1	36.5	162	P	P	P	69	A	36	P	49	A	33	2.3	A	98	CPAP 5		TTN			
												36.5	147	P	P	P	78	A	45	A	58	A	33	3	A							
												36.3	133	P	P	P	62	A	34	P	43	A	28	2.1	A							
											2	36.5	138	P	P	P	55	P	34	P	36	P	21	2	A							
												36.4	143	P	P	P	64	A	33	P	45	A	31	2.3	A							
												36.5	152	P	P	P	69	A	30	P	49	A	39	2.6	A							
												36.5	168	P	P	P	71	A	41	A	53	A	30	2.8	A							